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SPEED-FRATER®
ELECTRIC SWITCH MACHINE

FOR
RAPID TRANSIT YARD APPLICATIONS

INSTALLATION, OPERATION, MAINTENANCE

ALSTOM

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WARNING

When hand operating switch machines, keep head and body clear of the path of the hand-throw lever. Stored mechanical energy, caused by improper adjustment, shifts in rails and other switch components, or obstructions, can be transferred to the hand-throw lever during hand operation causing it to move rapidly and forcefully.

Difficulty in hand operating the switch could indicate a potential hazard. If any of these conditions are observed, check that the switch is adjusted properly as described in this publication.

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GENERAL DESCRIPTION

The GRS Speed-Frater®, shown in Figure 1, is a compact, electric switch machine designed for use in place of hand-throw switch stands, and for operation of derails and blue-flagging devices. It can be used in rapid transit yards and between stations where rolling stock move at low speeds.

The basic Speed-Frater is dual control — hand or power operation — and is trailable in either direction, forcing the switch points to the opposite position from which they have been set. As supplied, it is controlled and operates from a 115-volt, 60 Hz, single phase a-c power source. Speed of operation is less than one second from the time of closing the control circuit to receipt of indication. Unless equipped with optional automatic restoration, the machine is reversible in mid-stroke by operation of its control lever.

The basic machine includes independent internal circuit contacts to repeat its position (entirely separate from control and operating circuits). An indication can be given only after the machine has completed its stroke, correctly positioning point detector switches and deenergizing both contactors.

Optionally, the Speed-Frater can be provided with self-contained switch position indicators. A signal having a green lens and a yellow lens is built into each end of the deep-sided cover.

Another option is automatic restoration. If, for any reason, the machine is prevented from completing its stroke, a restoration relay (provided with slow release by a resistor/capacitor network) restores the machine to its starting position. The "open access" design of the Speed-Frater makes maintenance and inspection quick and easy. With the cover off, the position indicators, as well as all parts of the machine, are easy to get at. Removing an interior cover, held by two bolts, exposes the throw rod connection for adjustment.

The throw of the Speed-Frater is adjustable from a maximum of 5-1/2 inches to a minimum of 4-1/2 inches. A large eyebolt, part of the vertical shaft assembly, connects to one end of the throw rod — the opposite end couples to the No. 1 rod of the switch. Threading the eyebolt adjusts the switch machine throw to the throw of the switch.

INSTALLATION

Switch Layout

Figures 2 and 3 show typical switch layout. Layouts may vary in accordance with individual railroad standards. The Speed-Frater can be used in either a left-hand or right-hand layout.

Satisfactory operation of a power switch machine is largely dependent upon the condition of the switch and the layout. The switch machine location should be well-drained to avoid water accumulation around the machine. The ties supporting the machine should be reasonably straight and well-tamped over their entire length to withstand the vibration and strain from motive power and rolling stock.

To insure satisfactory power trailing, the switch machine requires track gage no wider the "normal" for a particular layout. Rolling stock at consistently slow speeds through a Speed-Frater will trail it properly if a narrower than normal track gage is used.

Mounting

1. Locate the switch machine on the ties in accordance with the layout, Figure 2. Cut out the tie, if necessary, to clear the chain well (Figure 4) of the machine.

2. With the eyebolt (Figure 16) assembled in the vertical shaft, align the hole in the eyebolt with the No. 1 rod of the switch. See Figure 2.

3. Drill four holes through the ties for mounting the switch machine.

4. Install 3/4-inch diameter rods, lock washers, angle washers (running from tie to tie), and nuts as required to hold the switch machine securely and to prevent any movement with respect to the rails.

   NOTE: The machine must lie flat on the ties without rocking. If necessary, use shims to stabilize the machine.

Switch Points

It is essential that the switch points move without drag or spring. The angle bars at the heel of the point rails should be slightly open to permit free operation of the points. To obtain the proper point opening, either bend the angle bars or use suitable ferrules in the bolt holes of the point rails.

Spring in the points is caused by the heel of the point striking the stock rail before the point strikes. To eliminate this spring, bend the stock rails or the points so the points fit properly.

Switch points should be held against the stock rail in both full normal and reverse positions. This is accomplished by adjusting the throw of the switch machine as described in this section under "Connection to Switch Points," Step 4.

Connection to Switch Points

1. Remove the rear coverplate, just above the eyebolt, from the base of the machine; see Figure 5.

2. Operate the switch machine by hand so that the eyebolt (Figure 16) is accessible in the outside position; refer to "Hand Operation" section under "OPERATION."

3. Adjust the eyebolt to give 1/4-inch more throw than the throw of the switch at the No. 1 rod. Rotate the eyebolt to make the throw adjustment. Note that one full turn of eyebolt changes the throw of the machine by about 3/32 inch.

4. Connect the jaw of the throw rod to the No. 1 rod. Referring to Figure 16, adjust the screw jaw on the throw rod and connect it to the eyebolt of the machine so that each point closes against its stock rail and causes about the same additional compression of the main spring on the horizontal crank of the machine in both the normal and reverse positions. If necessary, use rail stops to prevent the point rails from bending under heavy loads.

   NOTE: Hand operation gives a better feel for the condition and adjustment of the switch points than does power operation.

Wiring Connections

Connect the field wires in accordance with an approved plan. One method of control is shown in Figure 6, a typical wiring diagram for the basic Speed-Frater, using a double pole, double throw reversing switch. Any number of these switches can be used if enough voltage is provided to pick up the contactor in the switch machine. Figure 7 shows similar control for machines equipped with optional automatic restoration.

Referring to Figure 6, as the NX115 wire is common for both the contactor circuit and the motor circuit, this energy must come from the same source. This arrangement requires two wires for the contactor circuit and two for the motor circuit. The number of wires for indications depends on the circuit used.

For 95 to 130-volt operation of Speed-Fraters equipped with automatic restoration, set resistor R3 at 800 ohms. See Figure 15 for the location of R3. At 115-volts, the Speed-Frater running current normally does not exceed 14 amperes. Protect the 115-volt circuit with a 10-ampere, 250-volt, cartridge type, Fusetron (GRS 56449-10) or with a 10-ampere, 120-volt a-c, manual-reset circuit breaker (GRS 51943-67). Refer to the railroad's plans and specifications regarding the grounding of the switch machine.

Point Detection

Referring to "Hand Operation" in the "OPERATION" section, hand throw the switch slowly in each direction to determine if the point detection switches, Figure 14, close their indication contacts when the switch points are at the desired distance from the stock rail. If necessary, adjust the point detection switches for each position as follows:

1. Loosen the two screws 1 holding switch 2 to mounting plate 3.

2. Position switch 2 so that adjusting lever 4 just touches boss 5 around actuating pin 6 when roller 7 is on top of cam 8 as shown. The switch contacts must open at the desired obstruction of the switch points.

3. Tighten screws 1 to secure this position of the switch.

4. Repeat for switch 1 steps 1-3.

NOTE: After adjustment of point detection switches, test in each direction that sprocket detents capture the pin on the large sprocket at the end of "HAND" and "POWER" machine stroke against the desired maximum obstruction.

Track Circuits

Detection track circuits are recommended to prevent throwing a switch under a car or locomotive. The track circuit, in general, should extend far enough in advance of the switch points to permit completing of a switch movement before the leading wheels of the car or locomotive reach the points. Also, the track circuit should be of sufficient length as to prevent the longest wheel base of any equipment from spanning it.

If circumstances do not permit the use of track circuits, the basic Speed-Frater is recommended. However, when operating the machine under these conditions, caution must be exercised not to call for a move when a car or locomotive is on or approaching the switch.

Three recommended track circuits are described below:

1. Basic Speed-Frater — for use in areas where the track circuit will not be shunted when the switch machine is operating; refer to Figure 6.

   Both BX115 and NX115 control wires are interrupted by the track circuit relay. This prevents the switch from making a move when the track circuit is shunted. In this application, the track circuit need not extend beyond the switch points.

> **CAUTION**
>
> DO NOT use the basic Speed-Frater in areas where it is possible the machine will be called to make a move when a car or locomotive is approaching the track circuit protecting the switch. If the track circuit is shunted while the switch machine is in motion, the switch points could be left floating with a consequent derailment.

2. Speed-Frater with Optional Automatic Restoration — for use in areas where a car or locomotive will not pass over the switch points within 3 seconds after shunting the track circuit; refer to Figure 7.

   The BX115 control wire is interrupted with the track circuit relay. If the track circuit is shunted while the switch machine is in motion, the switch points will return to their original position. To make a switch move following automatic restoration, the operator must call for a switch move twice. The first call resets the restoration relay CP, and the second call operates the switch machine.

3. Speed-Frater with Optional Automatic Restoration — for use in areas where a car or locomotive will not pass over the switch points within 1-1/2 seconds after shunting the track circuit; refer to Figure 7.

   It is necessary to interrupt the BX115 control wire with the track circuit relay and TB3-4 and TB3-5 with another contact on the relay. If the track circuit is shunted while the switch machine is in motion, the switch points will return to their original position. To make a switch move following automatic restoration, the operator must call for a switch move twice. The first call resets the restoration relay CP, and the second call operates the switch machine.

Checkout

Refer to the WARNING on the title page before operating the switch machine by power, as described under "OPERATION."

Operate the switch machine by hand through several cycles to check that all parts function correctly and the switch points are in the proper position. Adjust as required, see Figure 2. On machines equipped with automatic restoration, power operate the switch and shunt the track circuit when the switch points start to move — the switch either completes the switch move or restores the switch points to their original position.

On machines with indicator lamps, if necessary, interchange the lenses to get the proper indications, or interchange wires 2 and 3 at one side of connector P.C. See Figures 6 and 7.

CAUTION

It is not good practice to "precondition" a switch machine by calling for a move while the track circuit is occupied. If loss of shunt occurs, and the track relay becomes energized, the basic Speed-Frater will throw the points, unless this is otherwise prevented. The Speed-Frater with restoration relay will also throw the points if the restoration relay has not released. If the restoration relay has released, nothing will happen.

OPERATION

Hand Operation

When hand operating switch machines, keep the head and body clear of the path of the hand-throw lever. Refer to the WARNING on the title page.

To operate by hand, raise the hand-throw lever from the power position to the hand-throw position. This action immediately opens the hand-throw switch to prevent power operation. The spring-loaded plunger pin, Figure 5, leaves a depression in the lever ring, thus opening the switch.

Pull the ring on the outside of the lever latch rod toward the handle of the lever; see Figure 4. At the same time, raise the lever to the horizontal position and release the ring. The latch rod can now engage the slot in the collar of the hand-throw bearing on the horizontal crank. It may be necessary to move the lever close to the opposite position before the latch rod will engage for the hand-throw operation.

With the latch rod engaged in the collar, operate by hand as required. The hand-throw bearing and large sprocket are splined to the spring-loaded horizontal crank so that, when the machine is trailed, the horizontal crank moves outward without displacing either of these parts.

To return the switch machine to power operation when the hand-throw lever is in its horizontal position, pull the ring and allow the lever to drop into the stand. Release the ring; the lever will drop to its lowest point in the stand and thereby close the hand-throw switch.

Power Operation

Whenever the hand-throw lever is below the horizontal in the lowest part of the right-hand or left-hand stand, the hand-throw switch is closed and the Speed-Frater can be power operated. Two mechanically interlocked contactors, shown in Figures 5 and 15, control the power operation.

The initiation of a normal or reverse control applies energy to the corresponding contactor. The contactor picks up to energize the motor and remains up until opened by the corresponding sprocket limit switch during a normal operating cycle.

The single-phase motor has a start winding and a run winding. Both are energized for starting the motor to produce the required torque. A capacitor, located on top of the motor and connected in series with the start winding, produces the required phase shift to initiate armature rotation. When the motor reaches a predetermined speed, a built-in centrifugal switch opens the start winding, and the motor continues to operate on just the run winding.

An adjustable overload torque limiter and sprocket are fastened to the output shaft of the gear-head motor. A chain connects this smaller sprocket to a larger sprocket, which is spline-connected to the horizontal crank.

Before the large sprocket reaches the end of its travel, a cross pin in the sprocket actuates a limit switch which deenergizes the contactor. Referring to Figures 6 or 7, the deenergized contactor opens the motor circuit and applies energy to the point detector circuit. At the end of the stroke, the cross pin strikes a positive stop and is captured by a mechanical detent. The torque limiter slips about one-half the distance between two sprocket teeth until the motor comes to rest.

A cam, mounted on the upper end of the vertical shaft, actuates the adjustable point-detection contacts that are used for indication purposes.

Mechanical Operation

Referring to Figure 16, the horizontal crank has an oblong T-head with a cavity that links the toggle to the vertical shaft. The toggle is held tightly in the cavity by the trapped toggle spring surrounding the horizontal crank. This is the normal mechanical arrangement.

In a trailing move through the switch, the throw rod eyebolt and toggle are moved in a counterclockwise direction. Riding the cavity of the T-head, the toggle goes over the crest of the incline and snaps to the other end of the cavity, thus completing the switch throw in the opposite direction. This is the trailed mechanical arrangement. The T-head does not turn in this operation, but simply moves axially under spring pressure as required without disturbing the position of any other part, due to the splined design of the horizontal crank.

In hand or power operation, the horizontal crank is turned 180 degrees (1/2 turn) and the vertical shaft 90 degrees (1/4 turn). The toggle is held by spring pressure in one end of the T-head cavity and moves with the T-head as it turns to the opposite position, thus throwing the switch. The sprocket and large lever bushing are splined to the horizontal crank, hence are not affected by any horizontal movement. In hand operation, the latch rod on the hand-throw lever engages in a slot in the lever bushing; see Figures 4 and 16.

Reversal in Midstroke

Wiring connections for the basic Speed-Frater not configured for automatic operation are shown in Figure 6. Note that the motor common is connected to the common (middle) of the contactor to enable the motor to reverse when the machine is at midstroke.

When the motor is at rest, the common side of the contactor circuit is connected to energy through contacts of the selector switch and motor-start switch. When the motor is running with the start switch open, resistor R1 is connected in series with the common side of the contactor circuit. The value of this resistor is such that the energized contactor will receive energy to remain picked up, but energy will be too low to pick up either contactor. This makes it necessary for the contactor to receive initial energy through the contacts of the motor start switch.

If the control circuit is reversed, the contactor which was up will release. The contactor called for will not pick up until the motor slows down enough to let the start switch close, at which time the contactor can pick up and the motor can be reversed.

If for any reason the machine does not complete its movement and the motor cannot restore the switch points to their original position, the customer-installed

circuit breaker or fuse protecting the motor circuit will release or blow, respectively.

Automatic Restoration

The slow-release restoration relay CP (Figure 7) is normally energized through a limit switch activated by the cross pin in the sprocket. When the Speed-Frater starts to operate, the sprocket turns, opening the limit switch and stick circuit of the CP relay. If the Speed-Frater operation is normal, the CP relay does not have time to release. However, if the switch machine takes too long to operate, the CP relay releases, causing the opposite contactor to pick up, which causes the switch machine returns to its starting position.

Any switch machine that can not complete its stroke has its motor protected from overload by either a circuit breaker or fuse in the 115-volt input circuit.

NOTE: To make a switch move following automatic restoration or a power outage, the operator may need to call for the move twice. The first call resets the CP relay. The second call then operates the switch machine.

Control Wiring

One method of switch control is shown in Figures 6 and 7. These diagrams illustrate switch control using one double pole, double throw, reversing switch. Any number of these switches can be used in series providing enough voltage is supplied to pick up the contactor in the switch machine. This permits control from several locations. Other circuits are shown in Figures 8, 8a, 9, 9a, 10, 11, 12 and 13. A switch machine should be field wired according to the diagram accompanying the switch machine. Reason for this is because a particular switch machine may be wired differently from the wiring diagrams in the manual.

Trailed Switch

WARNING

Keep hands and feet away from the open switch points when manually trailing the Speed-Frater. When the toggle rides over the crest inside the cavity of the T-head, the open point will snap closed suddenly by action of the strong toggle spring.

When trailed, the vertical output shaft of the Speed-Frater assumes the extreme opposite position mechanically, as described previously under "Mechanical Operation," and the indication contacts will indicate the point position. Therefore, the switch will be out of correspondence with the control lever position. However, indication lights in the control tower and on the switch machine, if so equipped, indicate the actual position of the switch points. The sprocket pin limit switches do not change state. On the next switch call, the contactor, which did not operate last, will operate, causing the Speed-Frater to go to the position it was in before being trailed. If necessary, the Speed-Frater can be restored from the trailed to the "pre-trailed" mechanical arrangement by trailing the machine a second time or by using a hydraulic rail clamp or jack to move the points over to manually trail them. Frequent trailing of the Speed-Frater will accelerate wear due to the high forces required.

Do not attempt to reverse a Speed-Frater equipped with automatic restoration in midstroke in the face of an oncoming car. The Speed-Frater will start to go reverse, but the CP relay will release and restore the machine to its originally called position (opposite the last called position).

MAINTENANCE

WARNING

Exposed terminals may contain dangerous voltages. Power and control energy must be disconnected from the switch machine prior to all inspections or adjustments unless otherwise specified. In the latter case, avoid touching exposed contacts.

It is recommended that a preventive maintenance program be established for periodic inspection, adjustment, and lubrication of the Speed-Frater at monthly intervals. The number of switch operations, number of trailing moves, and operating conditions at the switch location determines the need for more or less frequent inspections.

General

Keep the inside of the base and all internal parts clean and in good condition. If so equipped, inspect the indicator lights and if needed, replace them with GRS 34866-25 or an equivalent 13.5-volt, 17-watt bulb. Inspect the switch points, stock rail, and ties supporting the switch machine to make sure they are in good condition. If the switch is equipped with rail stops, check that they bear firmly against the stock rail when the switch is in its full normal and reverse positions.

Periodic Inspections and Adjustments

Before proceeding with the following inspections and adjustments, remove power to the machine and remove the switch machine cover to provide access to internal parts.

1. Hand-Throw Switch Contactor

   Raise the hand-throw lever to the hand-throw position; see "Hand Operation." Referring to Figures 5, 16, and 17, check the hand-throw switch contact opening while moving the hand-throw lever back and forth horizontally along the splined horizontal crank. The minimum contact opening should be 0.040-inch. If it is less, check the clearance between the hand-throw lever and the switch machine frame as described under "Hand-Throw Lever" in this section. If the hand-throw lever is positioned correctly, adjust the hand-throw switch as follows:

   a. Loosen the nut and screw holding the contact finger and remove it from the switch. See Figure 17.

   b. Bend the contact finger to increase the contact opening to 0.040-inch or greater.

c. Replace the contactor and recheck the contact opening. If necessary, remove and rebend the contact finger until the desired opening is obtained.

d. Check that the actuator pin strikes the insulated contact block on the contact finger. If necessary, reposition the switch.

2. Hand-Throw Lever

Raise the hand-throw lever to the hand-throw position; see "Hand Operation." Measure the clearance between the hand-throw lever and the switch machine frame, see Figure 18. It should be 0.020-inch or less. If it is greater, adjust the hand-throw lever as follows:

a. Remove the hand-throw lever guard and the premature pin-puller guard bracket; refer to Figure 4.

b. Loosen the set screw nut and remove the set screw from the hand-throw lever frame assembly; refer to Figure 18.

c. Grasp the hand-throw lever firmly with both hands. Raise the lever slightly above the horizontal position and pull it away from the machine -the hand-throw lever, bearing and shoe inside the bearing will disengage from the machine.

d. Remove the hand-throw bearing from the hand-throw lever assembly and examine it for excess wear. If necessary, replace it with bearing GRS 45536-12. Inspect the shoe for wear. If worn excessively, replace it with shoe GRS 57010-2.

e. Clean, if necessary, and lubricate the bearing with Lubriplate Mag-1 or equivalent NLGI 1 grease of adequate temperature range. Add shims (GRS 626-239) as necessary to reduce the clearance to .003 to .012 inches. Reinstall the bearing on the hand-throw lever assembly.

f. Replace the hand-throw lever, bearing, and shoe in the switch machine. Be sure the lever is in the same position, slightly above the horizontal, as when removed. The shoe in the bearing must be in line with the set screw in the frame.

g. Insert the set screw and turn it in fully. Make sure the set screw fully engages through the hole in the shoe.

h. Turn the set screw counterlockwise about 1/2 to 3/4 turn. Lock it in place using the locking nut, being careful not to change the set screw position.

i. Grasp the hand-throw lever with both hands and firmly pull it away from the machine. If the set screw is not properly engaged, the hand-throw lever will be loose. If loose, remove the hand-throw lever, bearing, and shoe. Then repeat Steps f through i.

j. Measure the axial clearance between the hand-throw lever and bearing. It should be 0.003 to 0.012-inch. If necessary, repeat the above steps.

k. Hand operate the switch machine in both directions. Observe the limit switch activator pin located on the large sprocket. It should meet the stop when the hand-throw lever is in the horizontal position. If not, remove the hand-throw lever as described above. Reinstall it by carefully following Step f.

3. Premature Pin-Puller Guard

Slowly hand throw the switch machine; refer to "Hand Operation." As the hand-throw lever is rotated, repeatedly attempt to disengage the hand-throw lever by pulling the ring on the outside of the lever latch rod toward the handle of the lever. The hand-throw lever should disengage only when it is in approximately the horizontal position.

If the lever can be disengaged in other than a horizontal position, proceed as follows:

a. Remove the hand-throw lever guard.

b. Check the premature pin-puller guard (see Figure 18) for wear or misalignment; it should be centered on and in contact with the hand-throw lever bearing. If necessary, bend the pin puller guard to restore proper alignment or, if necessary, replace with guard GRS 55478-71 Gr. 1.

c. Repeat the above procedure to check for proper operation. If necessary, repeat Steps a and b.

d. Replace hand-throw lever guard.

4. Torque Limiter

Connect 0 to 25 a-c ammeter in series with the motor circuit. This connection is between TB1-8 and contactor CL-2. See Figure 15. Disconnect one end of the electrical lead between these points. If the switch machine is configured for automatic restoration, remove the CP relay and place a jumper between TB3-6 and TB2-1; refer to Figures 7, 8 or 9 and the wiring diagram for the Speed-Frater.

Place an obstruction in the open switch point and power operate the switch machine. Measure the motor current as the torque limiter slips. It should be between 16 and 22 amperes when the voltage measured between TB1-8 and TB1-10 is 115 volts a-c.

Repeat the above procedure operating the switch in the opposite direction. If for either direction of operation the motor current fails to fall in the proper range, refer to Figure 19 and disassemble, reassemble and adjust the torque limiter as follows:

a. Bend the tab of the locking washer back against the pressure washer.

b. Remove the adjusting nut and remove the plates, washers, discs, and the sprocket, which comprise the torque limiter.

c. Measure the thickness of the friction discs. If less than 0.062-inch, replace them with GRS 45557-37.

d. Measure the thickness of the bushing inside the small sprocket. If less than 0.090-inch, replace it with GRS 39533-38.

e. Reassemble the torque limiter as shown in Figure 19.

f. Measure the motor current while operating the obstructed switch. Turn the adjusting nut clockwise to increase torque (increase amperes drawn by the motor) and counterclockwise to decrease torque (decrease amperes drawn by the motor).

g. When the motor current is proper (between 16 to 22 amperes for 115-volt operation), bend back the tab on the locking washer. If the switch machine is configured for automatic restoration, reinstall the CP relay and remove the shunt between TB3-6 and TB2-1.

5. Restoration Relay (if so equipped)

Place an obstruction in the open switch point and power operate the switch machine. The restoration relay CP will release, restoring the switch to its original position. If restoration fails to occur, refer to Figure 7, the wiring diagram for a switch machine equipped with automatic restoration. If the relay CP must be replaced, use GRS 36450-222.

6. Contacts

Open the motor circuit and activate the contactors by hand to determine that they operate freely. Check for some overtravel of the plunger after each contact is made; see Figure 15.

7. Drive Chain

Measure the distance between 12 pins of the chain. If it is more than 7-11/16 inches, replace the chain with GRS 58143-1. Check the slack in the chain as shown in Figure 20.

If necessary, loosen the four bolts holding the motor in place and move it forward or back to adjust the drive chain tension.

8. Vertical Shaft

Check the toggle arm for lateral movement; see Figure 16. If the toggle can be moved more than .005-inch, proceed as follows:

a. Remove the vertical shaft from the machine.

b. Remove the nut and bolt holding the toggle arm to the vertical shaft.

c. Examine the toggle arm and thrust washers. If the toggle arm is bent or severely worn, replace it with GRS 50571-6. Replace thrust washers if cracked or worn with GRS 49536-121.

d. Add shims (GRS 626-244) to the bolt and reassemble the toggle arm - vertical shaft assembly. Lubricate the arm with a film of Molykote G-N. Tighten the nut and insert the vertical shaft into the machine.

e. Check for lateral movement; if more than .005-inch, repeat Steps a through e.

Lubrication

1. Pressure Fittings

   Use an all-temperature lubricant, such as Lubriplate Mag-1, on all fittings. Wipe off excess or spilled lubricant. Figure 21 shows four pressure grease fittings: one in the frame assembly next to the hand-throw lever, two on the bearing cover in the rear, and one on the vertical shaft, which can be reached through the opening in the bearing cover.

2. Horizontal Crank

   With access through the opening in the rear bearing cover, spread a thin film of Molykote G-N or equivalent lubricant containing molybdenum disulfide, in the actuating socket of the T-head.

3. Motor Gear Head

   Lubrication is important for satisfactory operation. Correct oil level must be maintained. This is checked by removing the red plug when the motor is not running and observing that oil comes out. Use Shell Aero Shell No. 4 or equivalent the year round.

   Change the oil once a year. To do this, provide a container and remove the drain plug from the bottom of the gear-head frame; see Figure 22. Remove the filler plug in the top to assist in draining.

   To refill, replace the drain plug, remove the oil level plug and add lubricant until it begins to drip at the oil level plug. Then replace and tighten all plugs and wipe up any spilled oil.

4. Drive Chain

CAUTION

The plated sintered-bushing chain requires no lubrication. Lubricant inadvertently applied to the chain could eventually enter the clutch mechanism, thus causing the switch machine to operate improperly. The lubricant may also dissolve the chain's anti-rust compound.

5. Clutch

   DO NOT lubricate the clutch.

6. Hand-Throw Lever Bearing

Lubricate the hand-throw lever bearing only if it is necessary to adjust the hand-throw lever, see "Hand-Throw Lever" under "Periodic Inspection and Adjustments."

7. Sprocket Detents

   Sprocket detents were lubricated internally with Molykote G-N in the factory during assembly and require no further lubrication. When dry, lubricate only the sprocket pin and detent surface that contacts the sprocket pin, using Lubriplate Mag-1 or equivalent. See Figure 5 to locate parts to be lubricated.

Disassembly of Toggle Spring Assembly

WARNING

The toggle spring contains stored energy due to spring compression. Special parts are required for the safe disassembly of the toggle spring, spring seat, and bracket. Carefully follow Steps 1 through 7 to safely disassemble the aforementioned parts.

1. Dismantle the mechanism by removing the hand-throw lever guard, premature pin-pull preventer, bearing cover with the vertical shaft, horizontal crank, chain, and large sprocket. See Figures 5 and 23.

2. Obtain or fabricate special parts consisting of:

   1 - 1" x 10" bolt with about 3" of thread
   2 - 1/2" x 2-1/2" x 4-1/2" rectangular steel plate with hole for 1" bolt (see Figure 24)
   1 - 1" hex nut
   2 - 5/8-11 x 2-3/4" hex head screw

3. Assemble the 1" by 10" bolt, 1" nut, and two rectangular steel plates as shown in Figure 23. Hand tighten nut against plate and then turn nut one full revolution with wrench to slightly compress the toggle spring.

4. Remove the two hex head screws holding the spring bracket.

5. Relieve the spring compression by slowly loosening the 1" nut.

6. Reassemble the spring, spring seat and bracket as a unit and then place in frame. Use two 2-3/4" hex head screws to hold the unit in alignment.

7. Assemble the 1" by 10" bolt, 1" nut and rectangular plates as done in Step 3. Slowly draw spring assembly up in place.

8. Remove one of the two 2-3/4" hex head screws and replace it with the hex screw supplied with the mechanism.

9. Slowly loosen the 1" nut until spring compression on the 1" bolt is released. Remove the nut, plates and bolt. The reassembly of the toggle spring assembly is now complete.

Replacement of Bushings for Vertical Shaft

1. Remove four hex head screws and bearing cover from the switch machine. See Figures 5 and 21.

2. Remove two grease fittings from the bearing cover and drive out the spring pins. Note position of each fitting before removing them from cover.

3. Take out spring pin, if present, in lower frame and discard.

4. Assemble the bearing cover to the frame with new bushings but without the vertical shaft.

5. Use a 1/4 inch drill bit through each grease hole in the bearing cover. Drill completely through one side of each bushing.

6. Remove bearing cover and bushings. Deburr the bushings.

7. Reassemble spring pins and grease fittings in bearing cover. Be sure grease fittings are pointed up so that when the bearing cover is in place access to each fitting is easy. Check that spring pins stick out no more than 1/8 inch into the bore of the verical shaft.

8. Drive out the spring pin which holds the cam on the vertical shaft. Remove cam and old bushing.

9. Position new upper bushing (non-split) on the vertical shaft with the flange up.

10. Place undrilled half of split bearing in machine frame with flange down.

11. Insert the vertical shaft in the machine frame. Position the drilled hole in the upper bushing so that it faces away from the frame. Line up the drilled hole in the bushing with the pin in the bearing cover.

12. Place the drilled half of the split bushing (flange down) on the vertical shaft. Next, line up the drilled hole with the pin in the bearing cover.

13. Replace the bearing cover. Line up the bearing cover pins with holes in the bushings. Tighten the four hex head screws.

14. Position the cam on the vertical shaft so that it will operate the point detection switches. Secure the cam with the spring pin removed in Step 8.

15. Grease the vertical shaft through the grease fittings. The switch machine is now ready for power operation.

16. Test the switch machine for proper operation by making an obstruction test at the switch points.

Troubleshooting

Examples of some potential problems and associated corrective actions are shown below as a guide for the maintainer when troubleshooting the switch machine. These examples cover troubles that are most likely to occur. Read **WARNING** on page 10 before proceeding any further.

Trouble Sympton	Corrective Action
1. Motor runs continuously but points do not move.	1. a. Clutch slips - see torque limiter test and adjustment. b. Object in points - remove object. c. Linkage disconnected - reconnect rod linkage to switch points.
2. Motor will not start.	2. a. Hand-throw lever not in POWER position. b. Check power circuit to switch machine. Test for proper voltage between TB1-8 and TB1-10. c. Check for control voltage at TB1-6 and TB1-7. See application circuits. d. Check sprocket pin limit switches and wiring if contactor receives no voltage. Replace SW3 or SW4 as necessary. e. If voltage present at contactor and contactor does not operate, replace coil or contactor. f. Check wiring to connector and check for burned contacts if contactor operates but motor does not turn. Inspect hand-throw contact.
3. Switch indication lamps do not light.	3. a. Check for proper voltage at TB1-2 and TB1-1. b. Check for voltage across transformer and at plug connector PC. If no voltage at connector, replace point detector switch SW1 and SW2 or wiring as necessary. c. Check wiring between plug connector PC and each 13.5 volt lamp on the cover.
4. A machine with automatic restoration does not restore when points are obstructed.	4. a. Verify continuity of wiring between TB2-1 and TB3-6 when machine is ready to operate. If continuity is verified, the restoration relay is picked up. If CP relay is not picked up, check sprocket pin limit switches SW3 and SW4 for proper operation. Both switches must be closed in midstroke operation. Note that after CP relay releases, the control circuit must be pole changed twice before the machine operates because the first pole change resets the restoration relay.

b. If CP is picked up initially, verify it releases about two seconds after the machine starts to operate.

Ordering Information

When ordering replacement parts, please refer to GRS Catalog P85, Parts List, to find the location and drawing number. State the name and catalog number of each part ordered and give the quantity of each too.

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Figure 6. Typical wiring diagram for the basic Speed-Frater with lamp indication units; 115-volt operation, control using a double throw, double pole, reversing switch.

Figure 7. Typical wiring diagram for Speed-Frater equipped with optional automatic restoration; 115-volt operation, control using a double throw, double pole, reversing switch.

Figure 8. Typical wiring diagram for Speed-Frater equipped with optional automatic restoration for rapid transit single switch.

Figure 8a. Typical wiring diagram for Speed-Frater without automatic restoration for rapid transit single switch.

Figure 9. Typical wiring diagram for Speed-Frater equipped with optional automatic restoration for relay end of rapid transit crossover.

Figure 9a. Typical wiring diagram for Speed-Frater without automatic restoration for relay end of rapid transit crossover.

Figure 10. Two typical control circuits for a single switch application.

Figure 11. Typical single switch repeater circuit for Speed-Frater in rapid transit application - NWP energized.

Figure 12. Two typical control circuits for crossover switch application.

Figure 13. Typical crossover switch repeater circuit for Speed-Frater in rapid transit application - RWP energized.

Figure 14. Point detection switch adjustment.

Figure 15. Contactor and component plate.

Figure 16. Relation of toggle and T-head.

Figure 17. Hand-throw switch contactor.

Figure 18. Correct position of hand-throw lever and switch machine frame.

Figure 19. Torque limiter.

Figure 20. Chain slack adjustment.

Figure 21. Location of pressure fittings.

Figure 22. Location of plugs on motor gear head.

Figure 23. Details of toggle spring assembly.

Figure 24. Steel plate details.

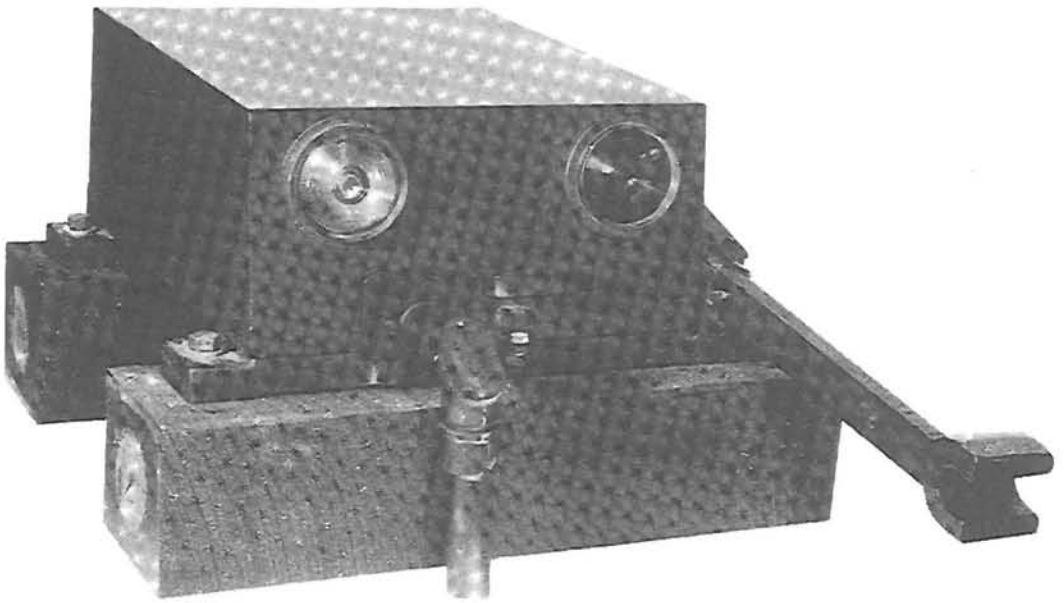

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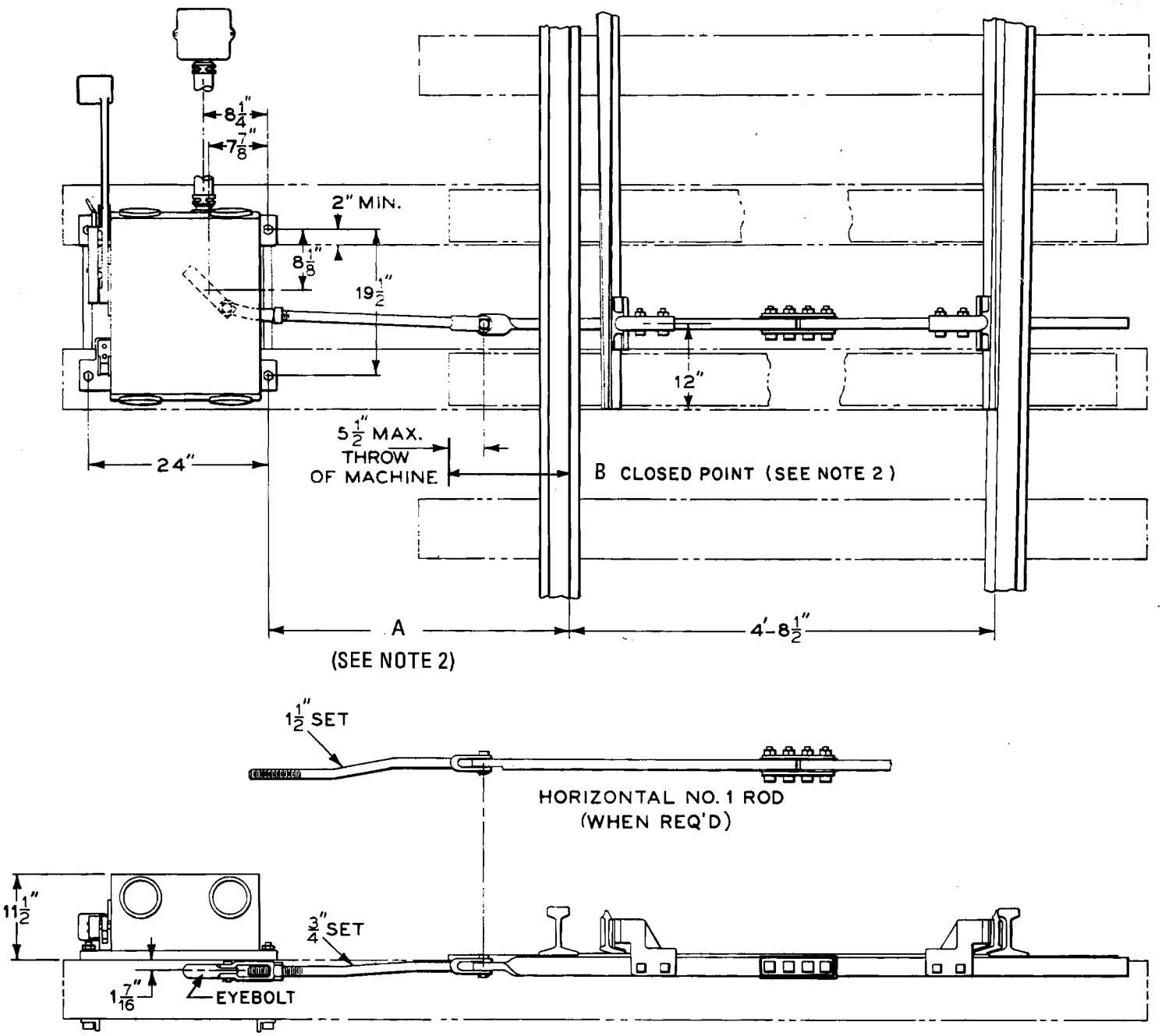
Figure 1. Speed-Frater switch machine.



NOTE: 1. Actual switch layouts may vary according to individual railroad standards and individual state regulations.

2. Dimensions vary from layout to layout. See the layout for your installation.

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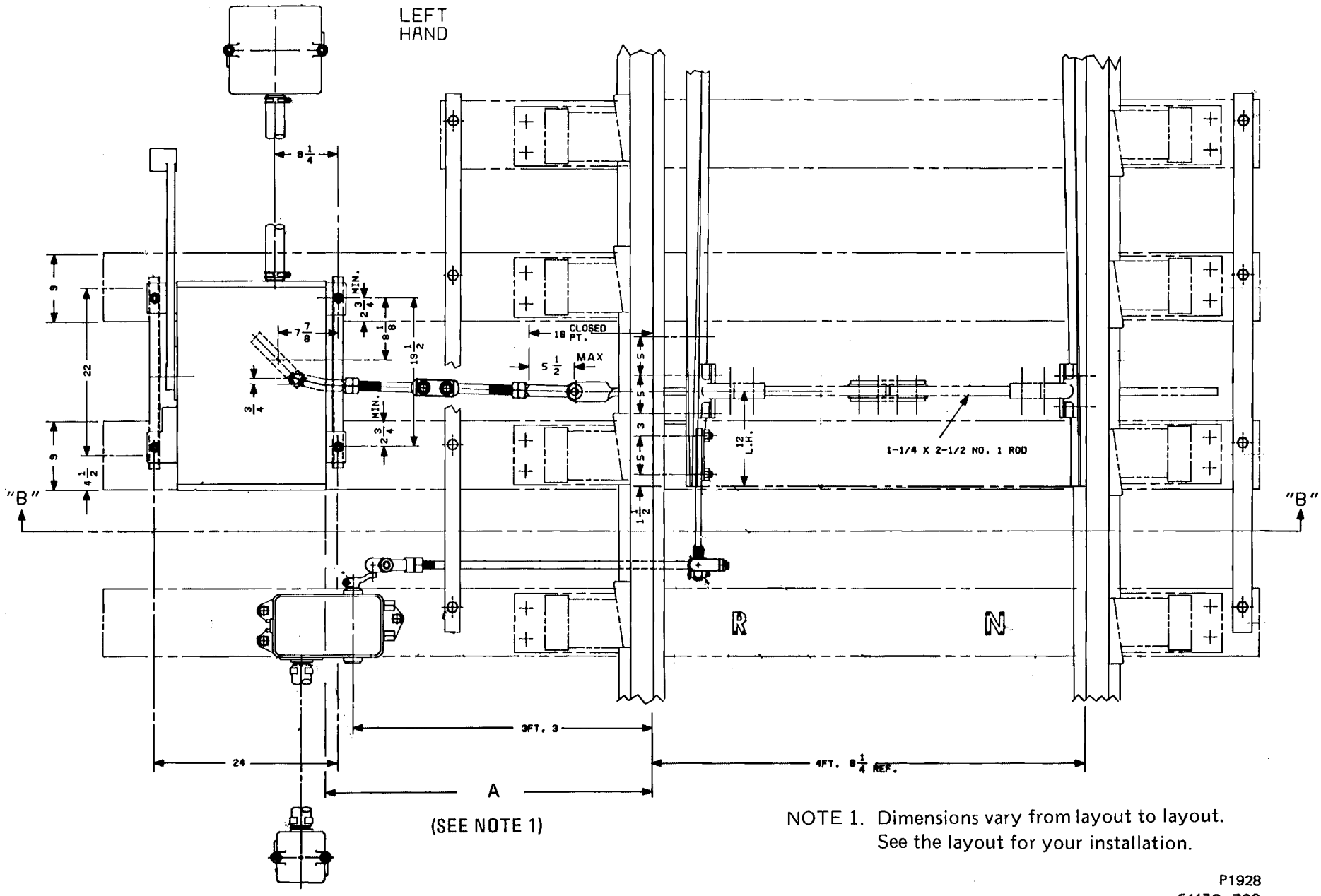
Figure 2. Typical switch layout.



NOTE 1. Dimensions vary from layout to layout. See the layout for your installation.

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Figure 3. Typical rapid transit switch layout (page 1 of 2).

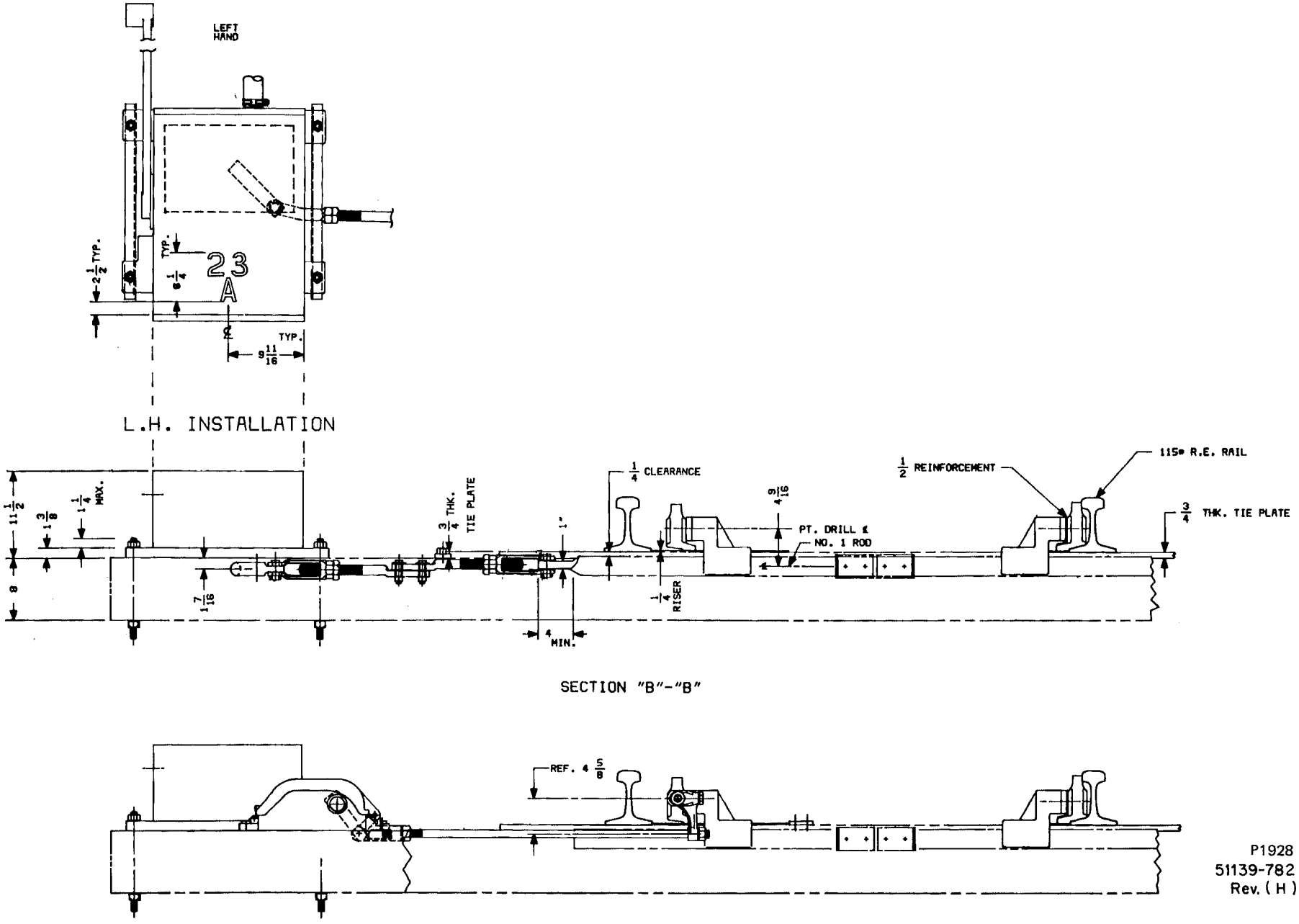

Figure 3. Typical rapid transit switch layout (page 2 of 2).

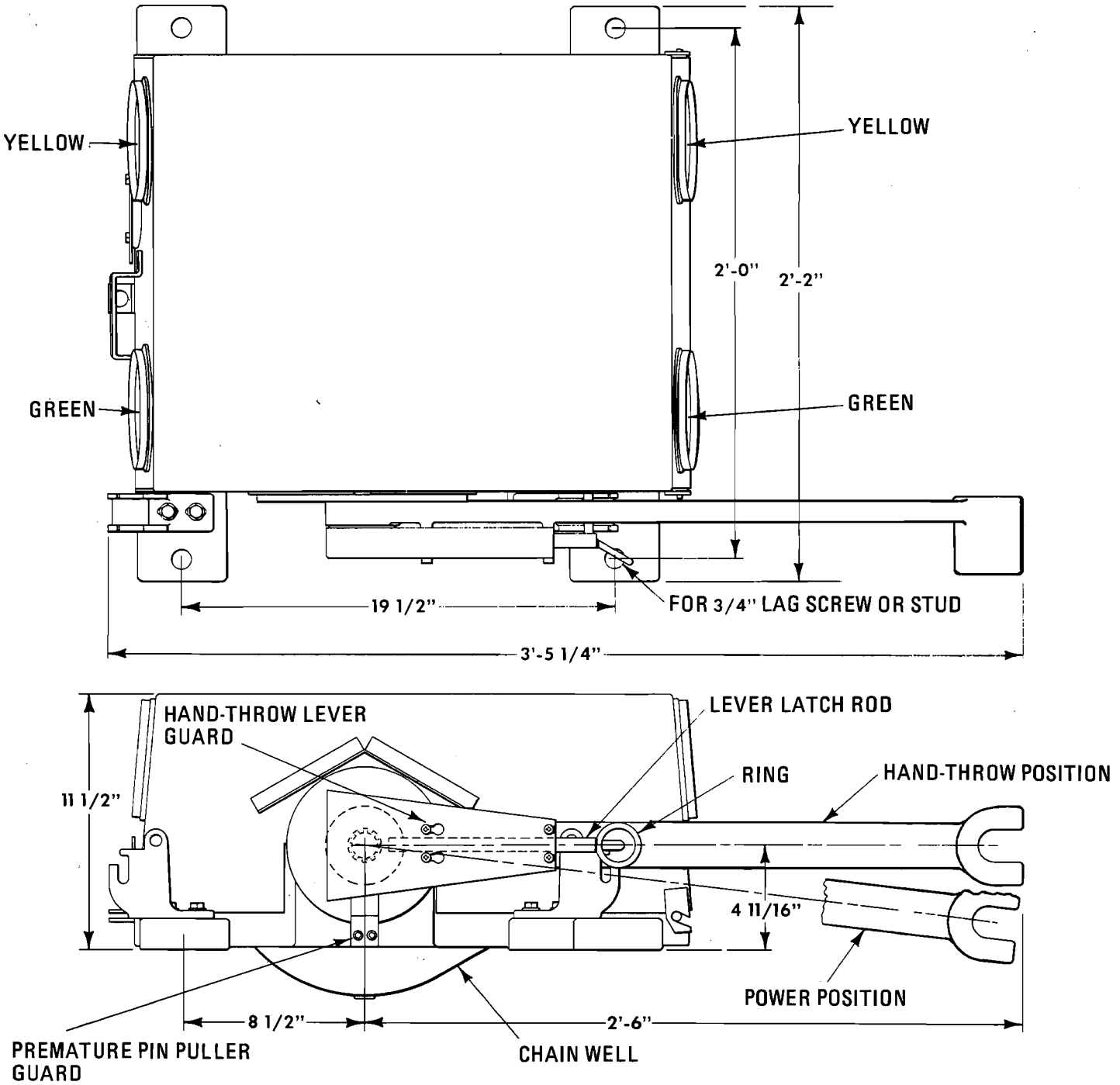

Figure 4. External dimensions of the Speed-Frater and hand-throw lever positions.

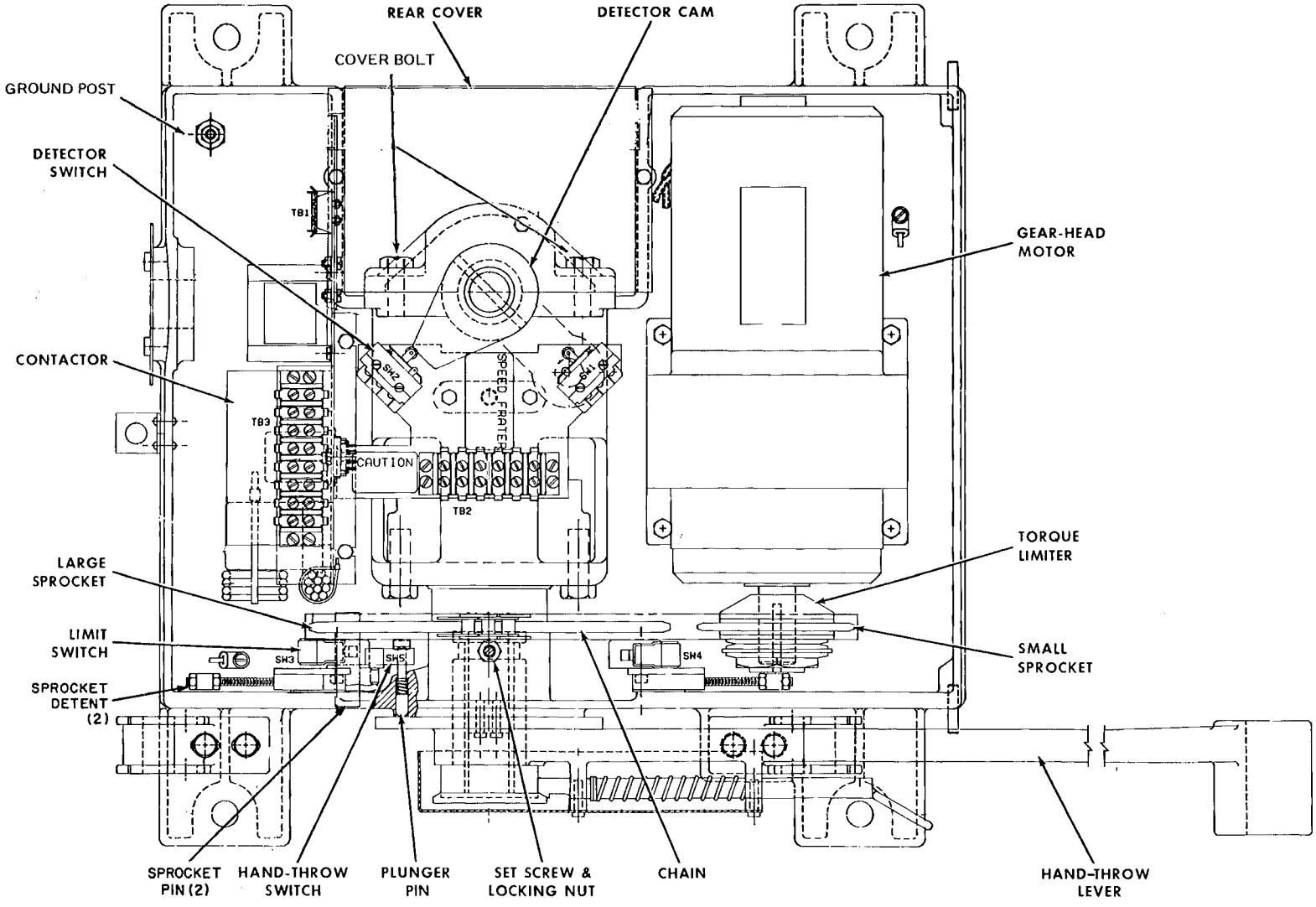

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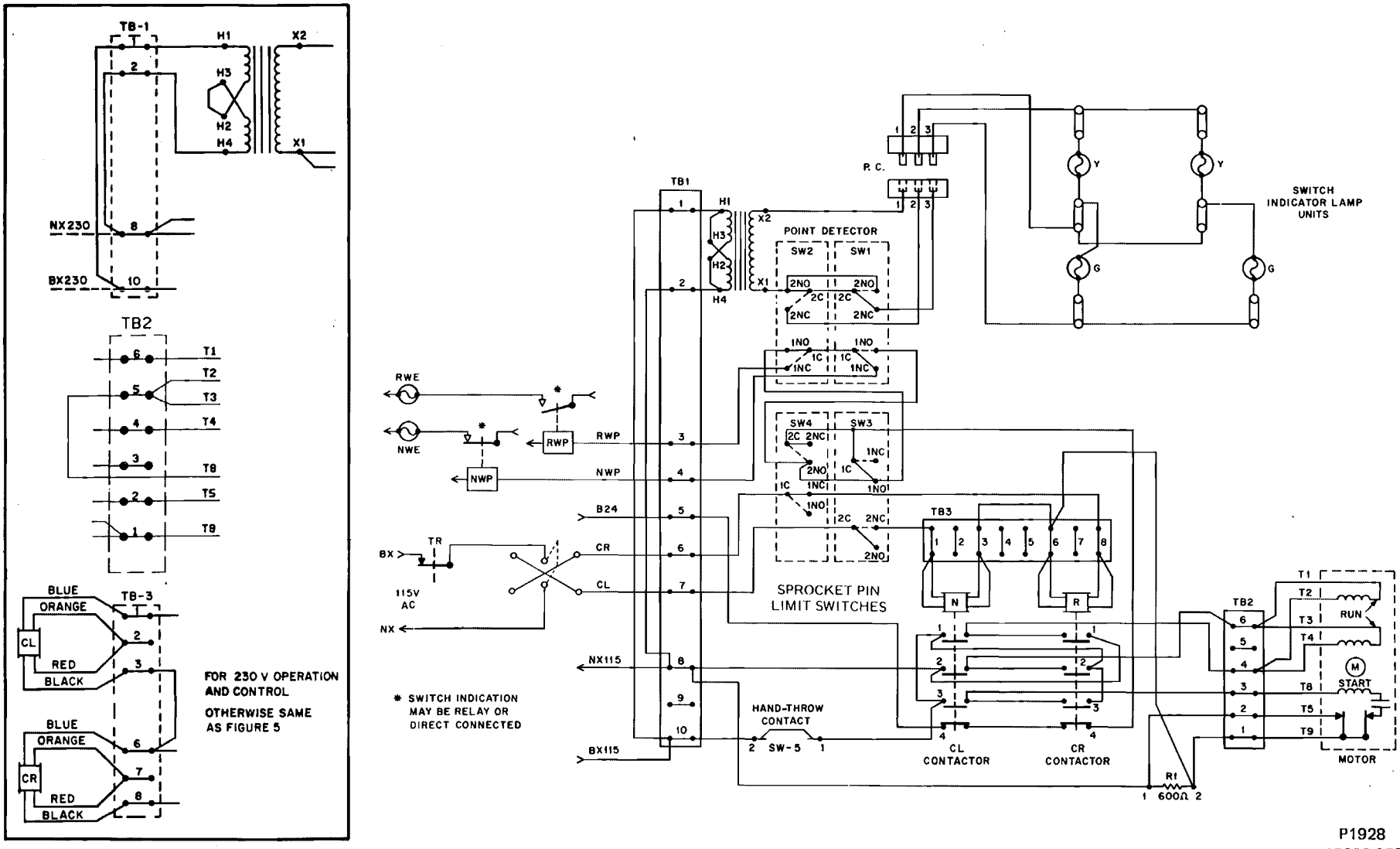
Figure 5. Internal arrangement, cover removed.



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Rev. (E)

Figure 6. Typical wiring diagram for the basic Speed-Frater with lamp indication units; 115-volt operation, control using a double throw, double pole, reversing switch. Switch 2 and switch 3 are shown actuated. Switch 1 and switch 4 are shown "normal" unactuated.

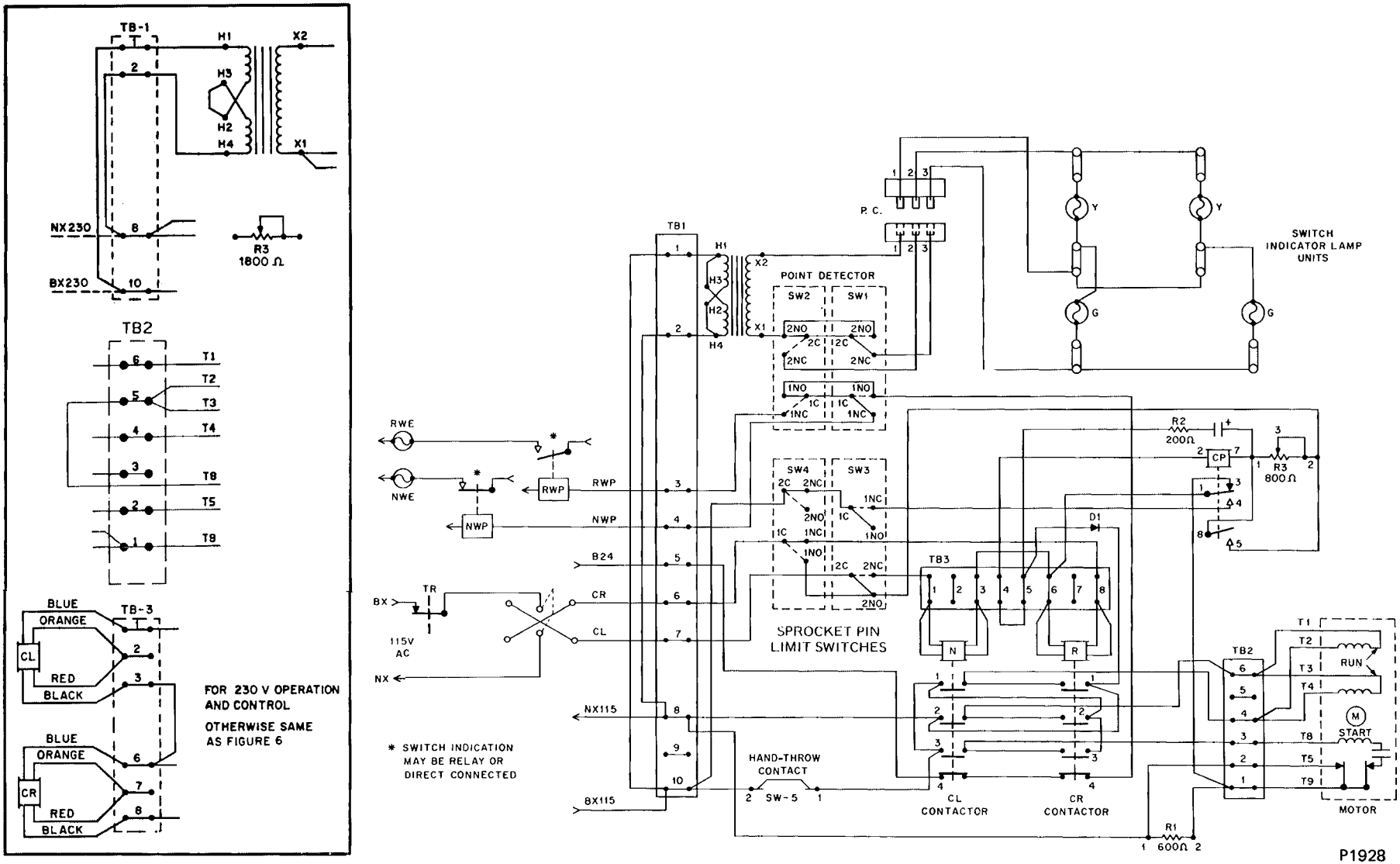

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Figure 7. Typical wiring diagram for Speed-Frater equipped with optional automatic restoration; 115-volt operation, control using a double throw, double pole, reversing switch. Switch 2 and switch 3 are shown actuated. Switch 1 and switch 4 are shown "normal" unactuated.

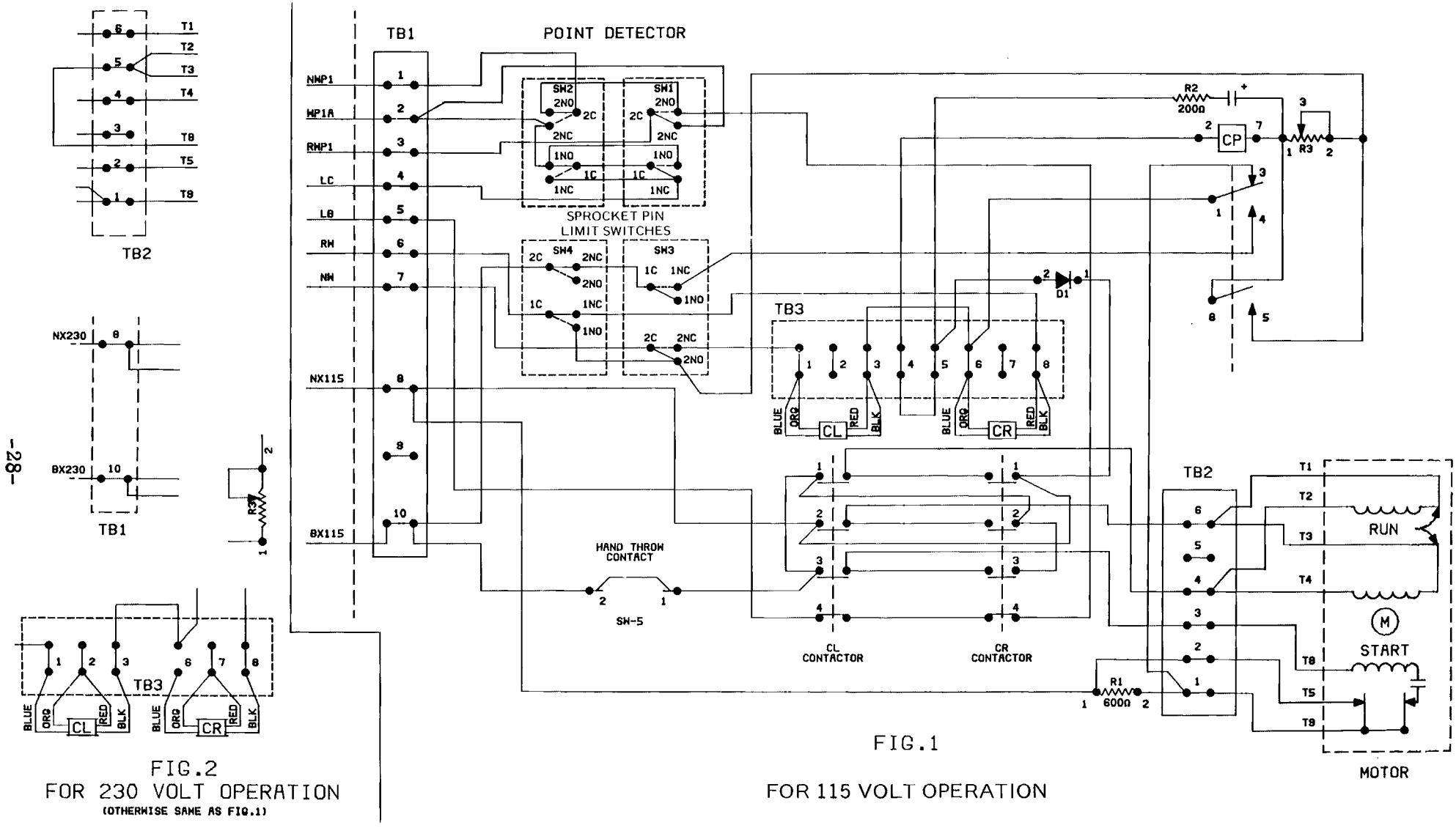

FIG.2
FOR 230 VOLT OPERATION
(OTHERWISE SAME AS FIG.1)

FIG.1
FOR 115 VOLT OPERATION

Figure 8. Typical wiring diagram for Speed-Frater equipped with optional automatic restoration for rapid transit single switch. SW2 and SW3 are shown actuated. SW1 and switch SW4 are shown "NORMAL" unactuated.

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Rev.(C)

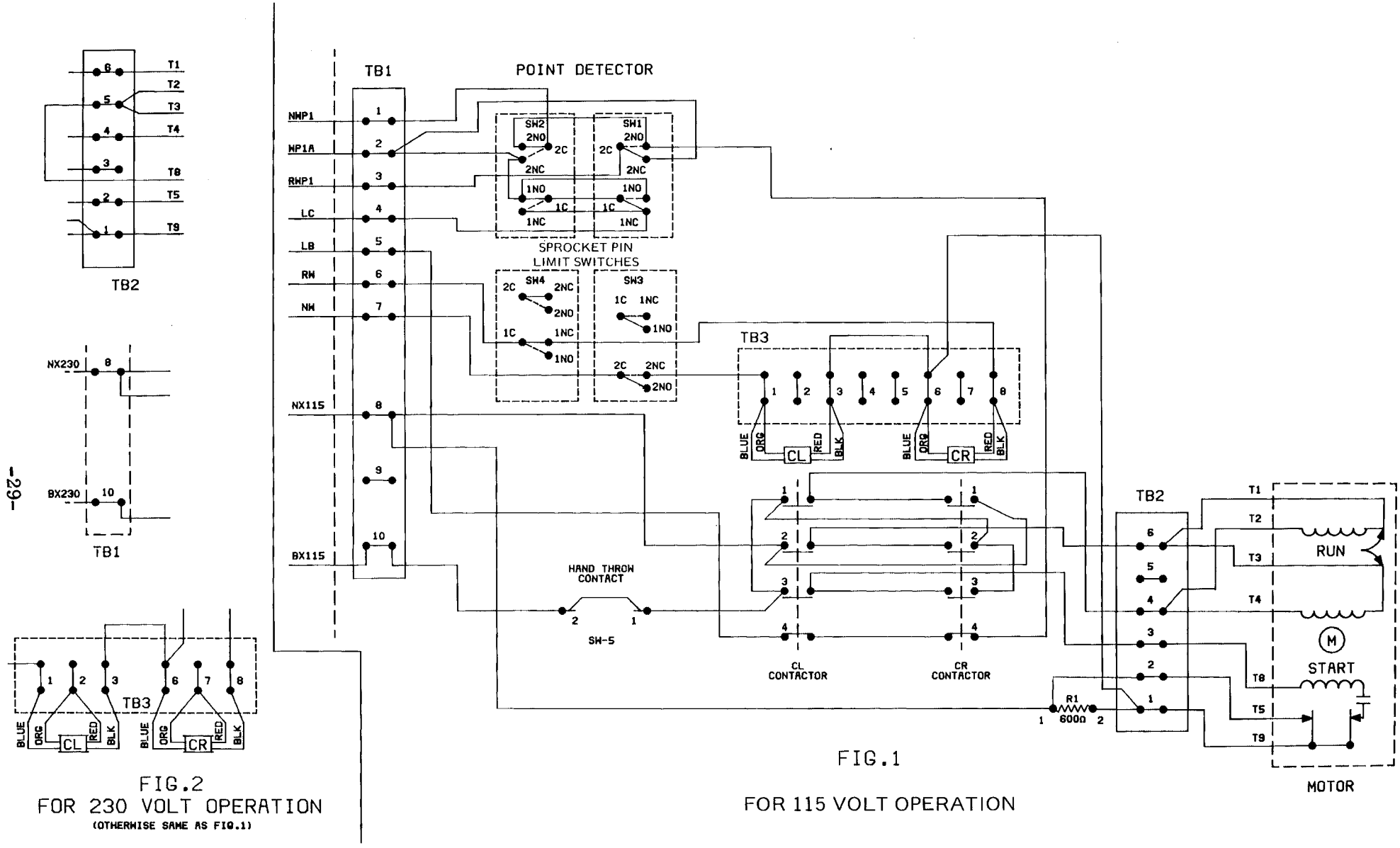

Figure 8a. Typical wiring diagram for Speed-Frater without automatic restoration for rapid transit single switch. SW2 and SW3 are shown actuated. SW1 and switch SW4 are shown "NORMAL" unactuated.

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Rev.(A)

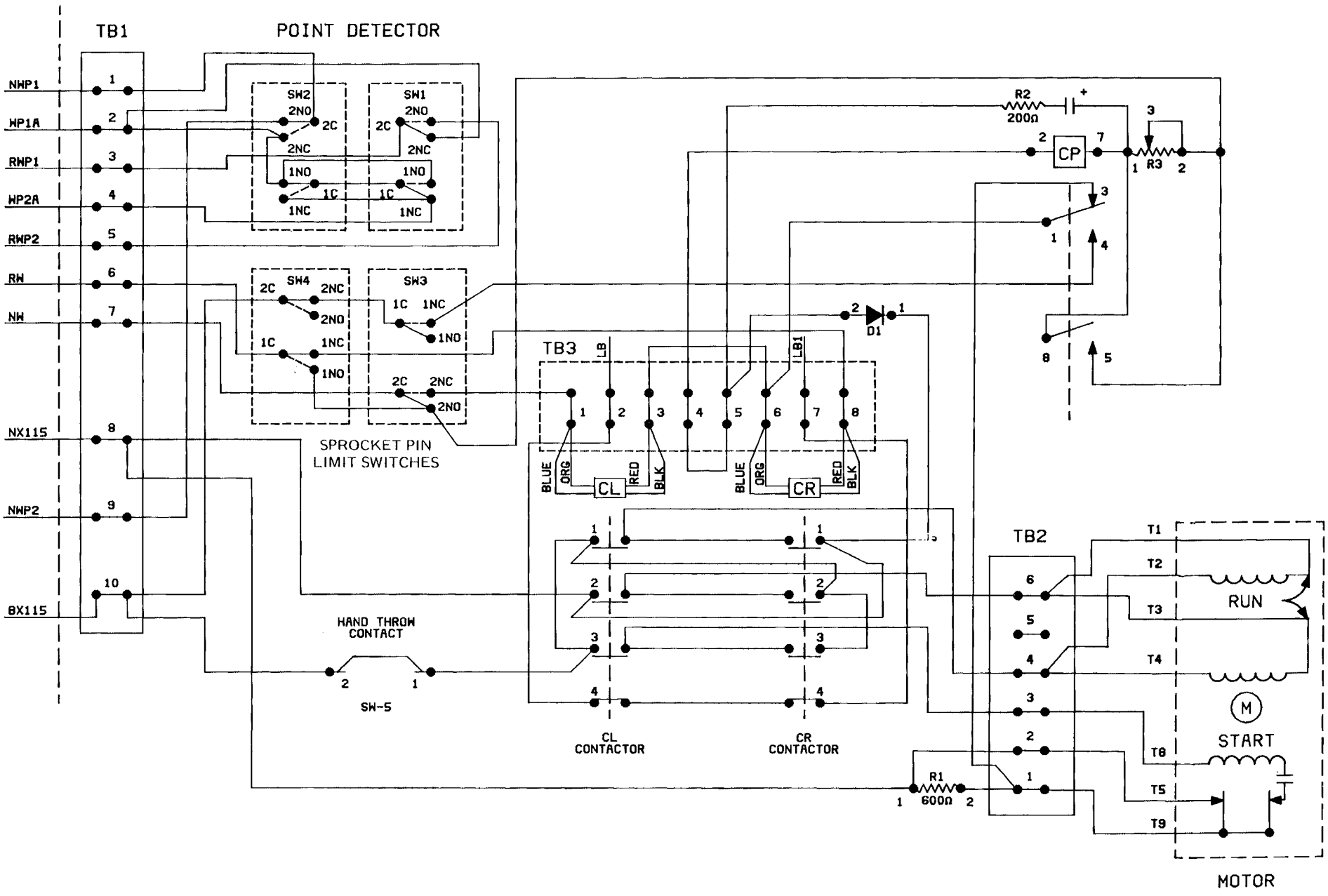

Figure 9. Typical wiring diagram for Speed-Frater equipped with optional automatic restoration for relay end of rapid transit corssover. SW2 and SW3 are shown actuated. SW1 and SW4 are shown "NORMAL" unactuated.

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Rev.(B)

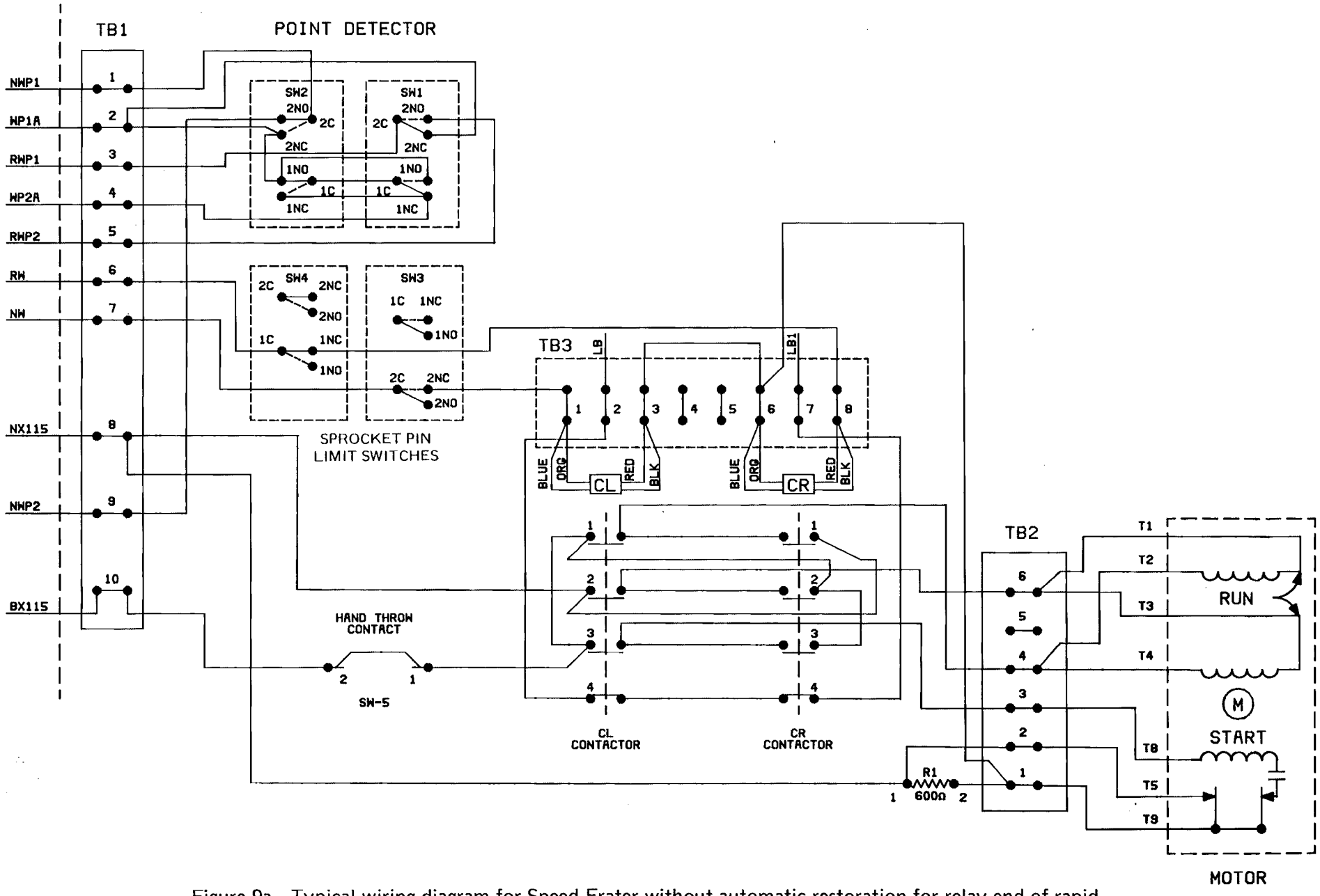

Figure 9a. Typical wiring diagram for Speed-Frater without automatic restoration for relay end of rapid transit crossover. SW2 and SW3 are shown actuated. SW1 and SW4 are shown "NORMAL" unactuated.

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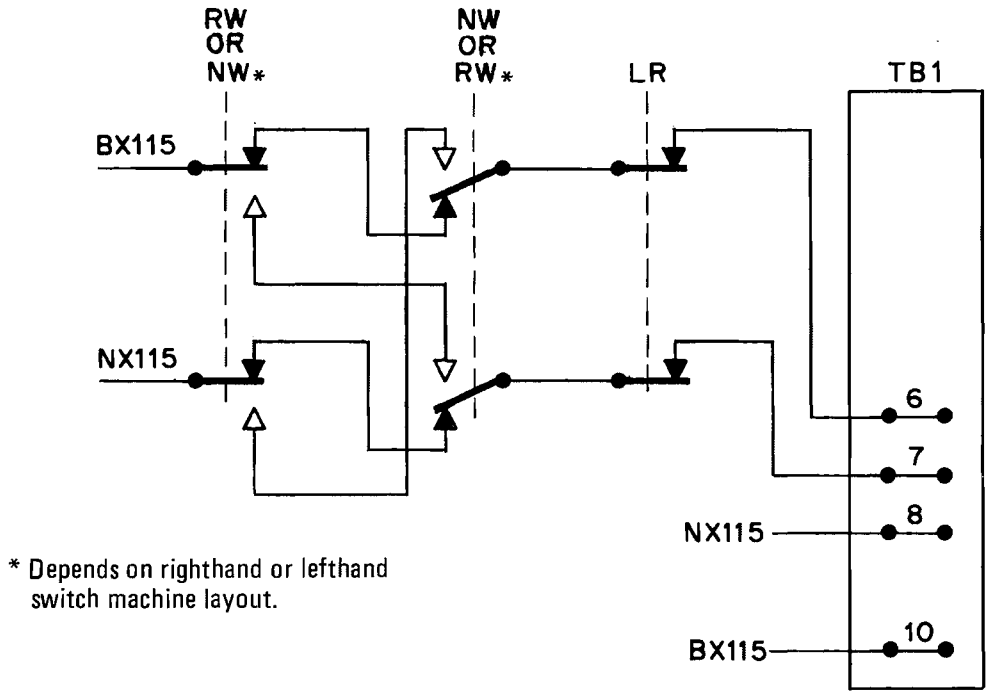
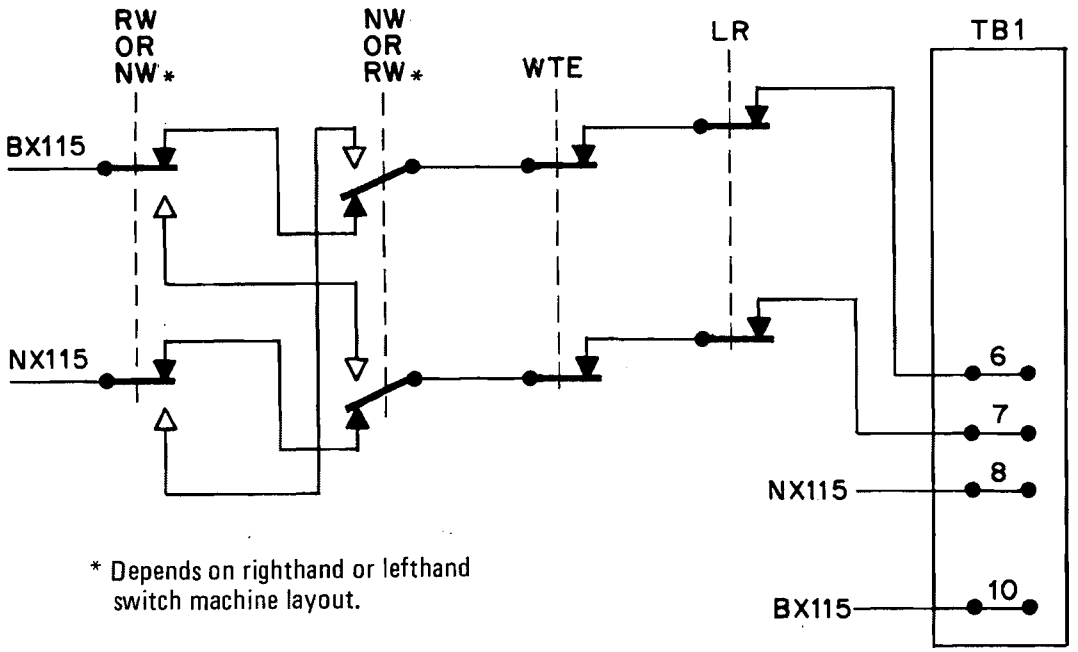
Rev. (A)



A. For switch with automatic restoration and without external timer relay contacts.



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B. For switch without automatic restoration and with timer relay contacts.

Figure 10. Two typical control circuits for a single switch application.

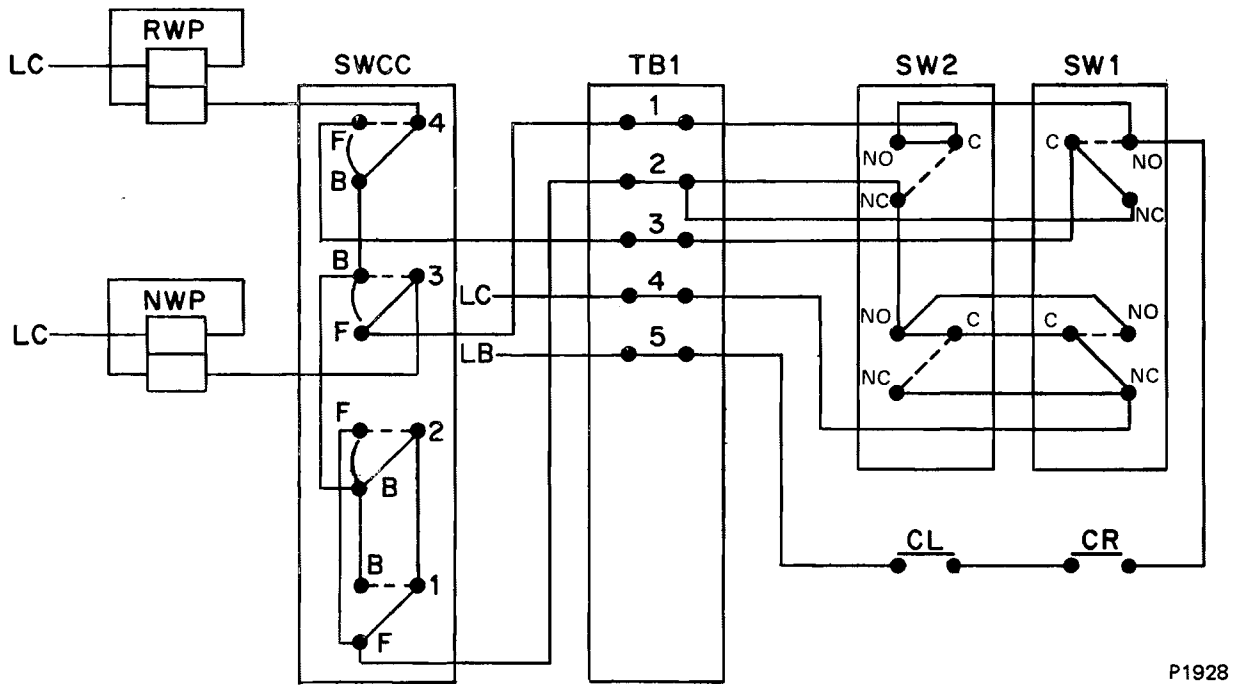

Figure 11. Typical single switch repeater circuit for Speed-Frater in rapid transit application — NWP energized.

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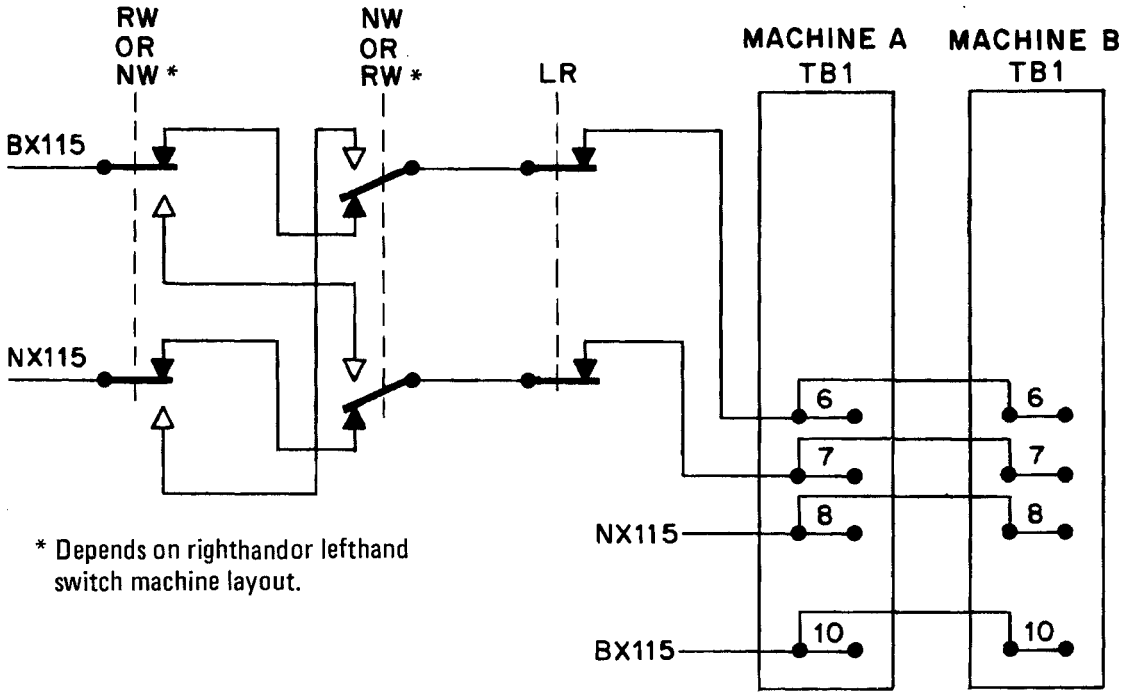
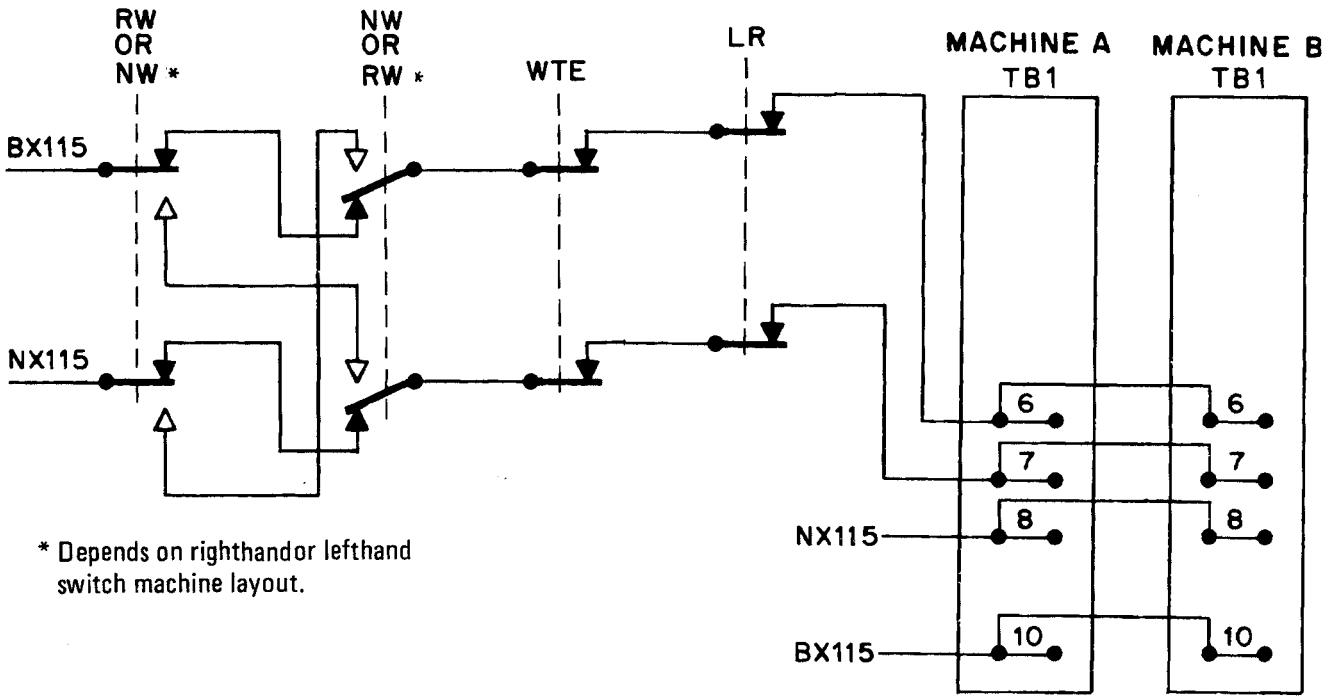


A. For switch with automatic restoration and without external timer relay contacts.



B. For switch without automatic restoration and with timer relay contacts. P1928

Figure 12. Two typical control circuits for crossover switch application.

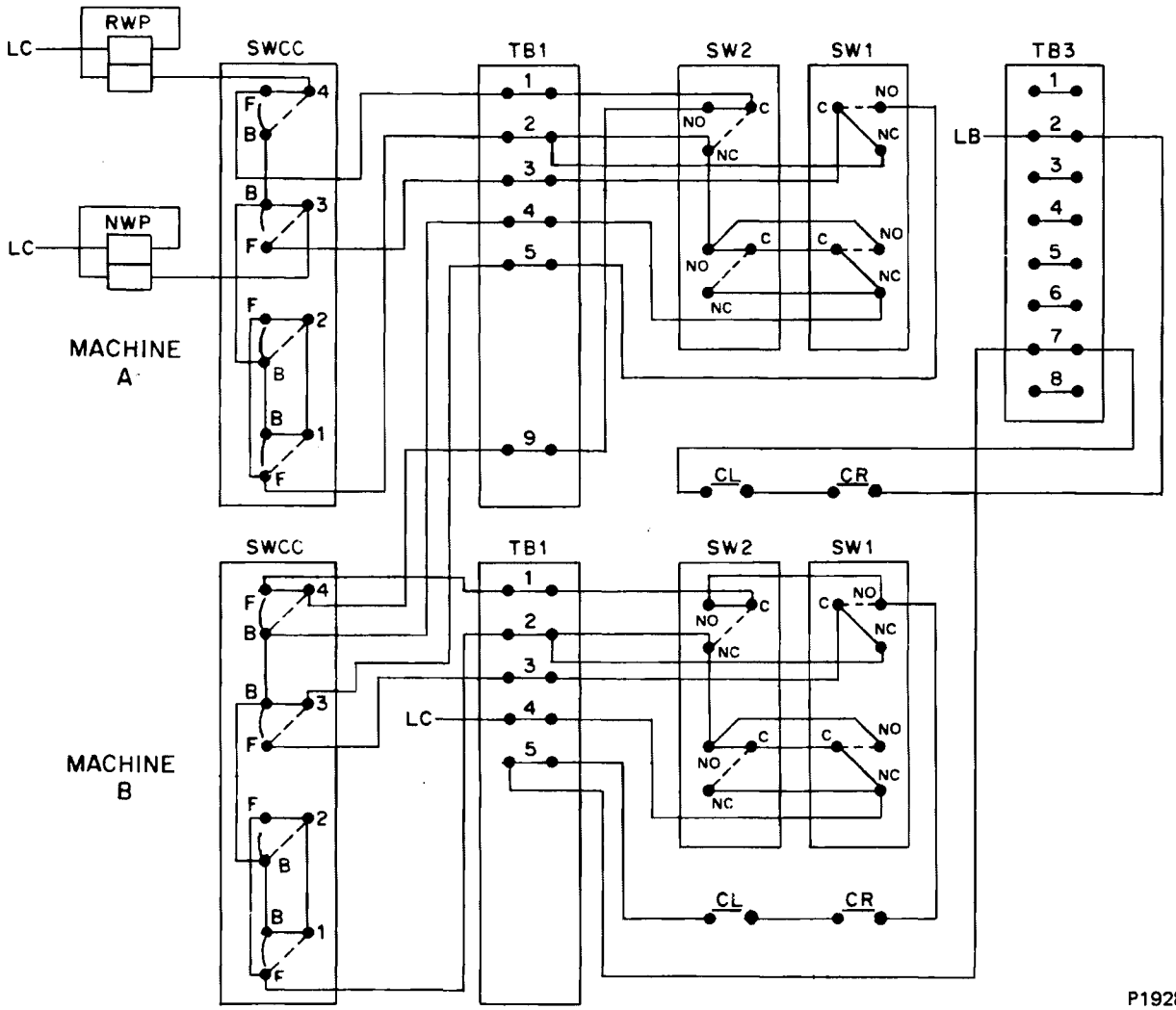


Figure 13. Typical crossover switch repeater circuit for Speed-Frater in rapid transit application — RWP energized.

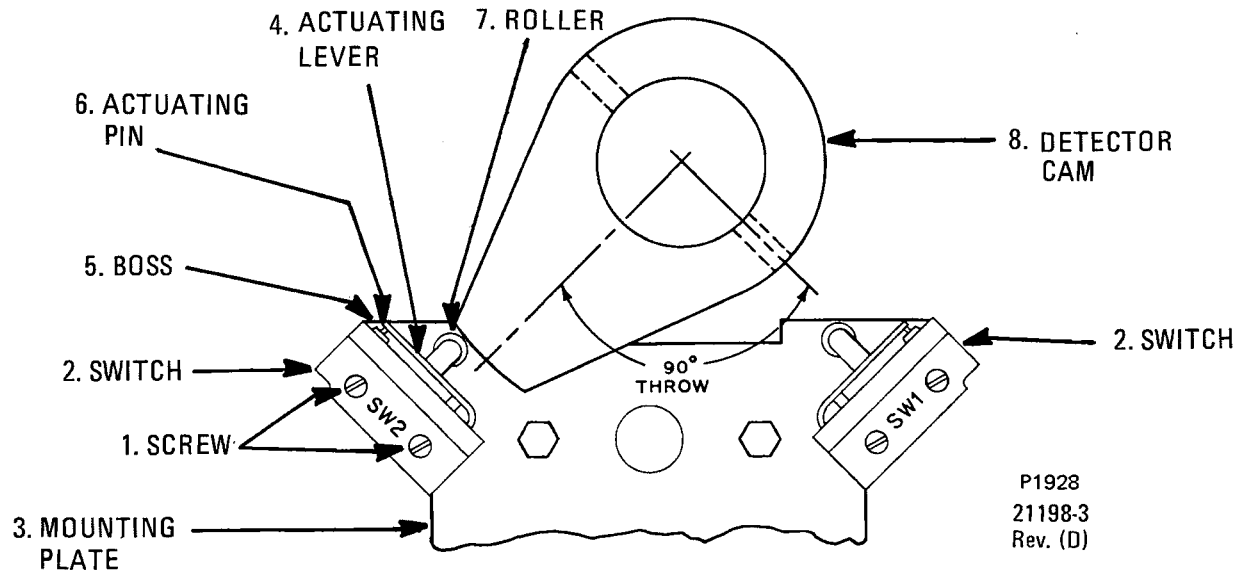


Figure 14. Point detection switch adjustment.

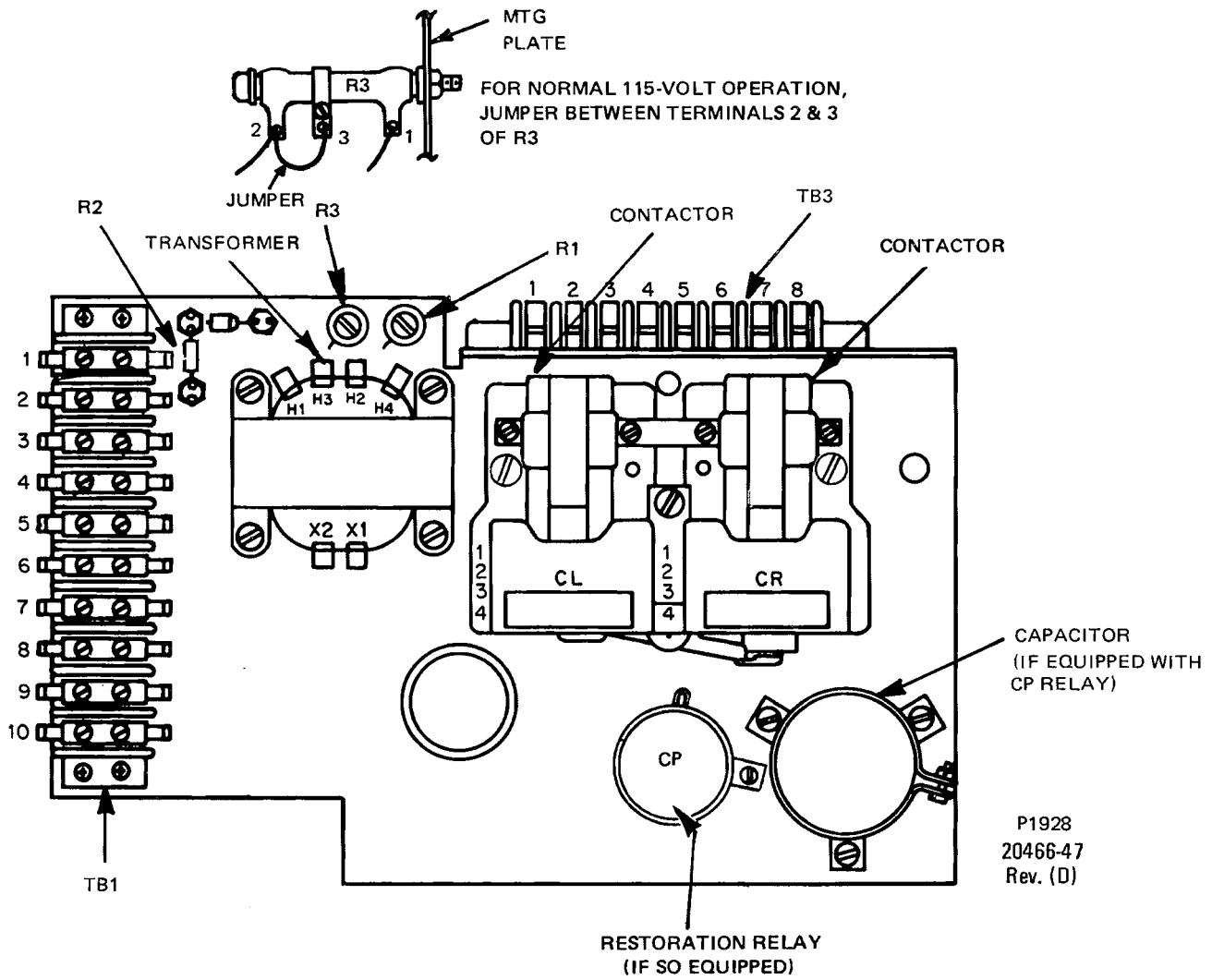


Figure 15. Contactor and component plate.

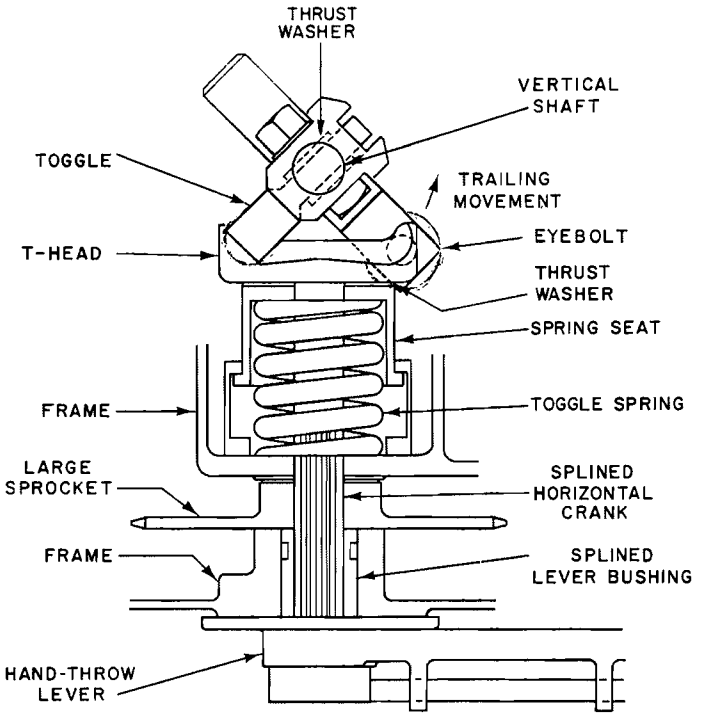


Figure 16. Relation of toggle and T-head.

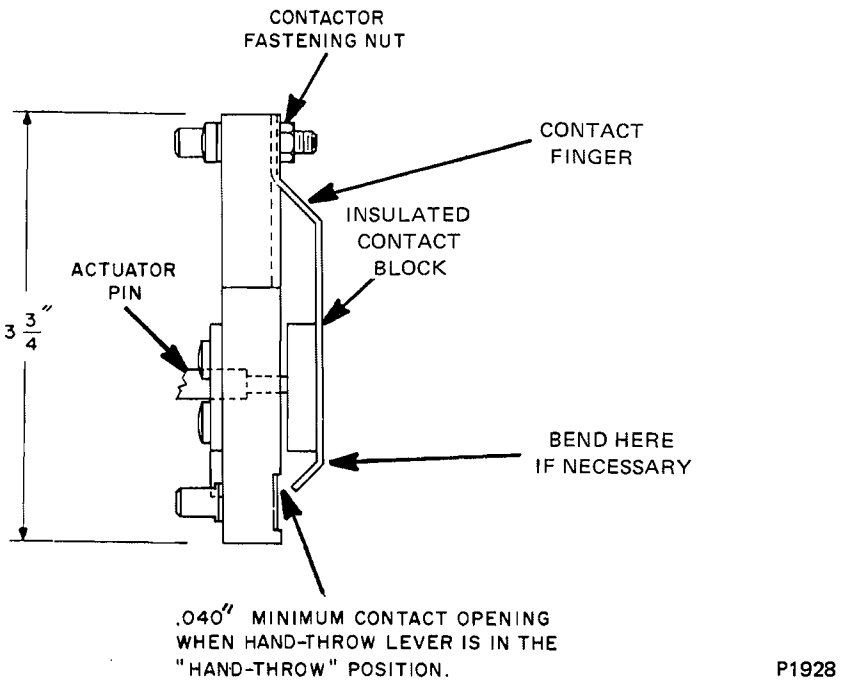


Figure 17. Hand-throw switch contactor.

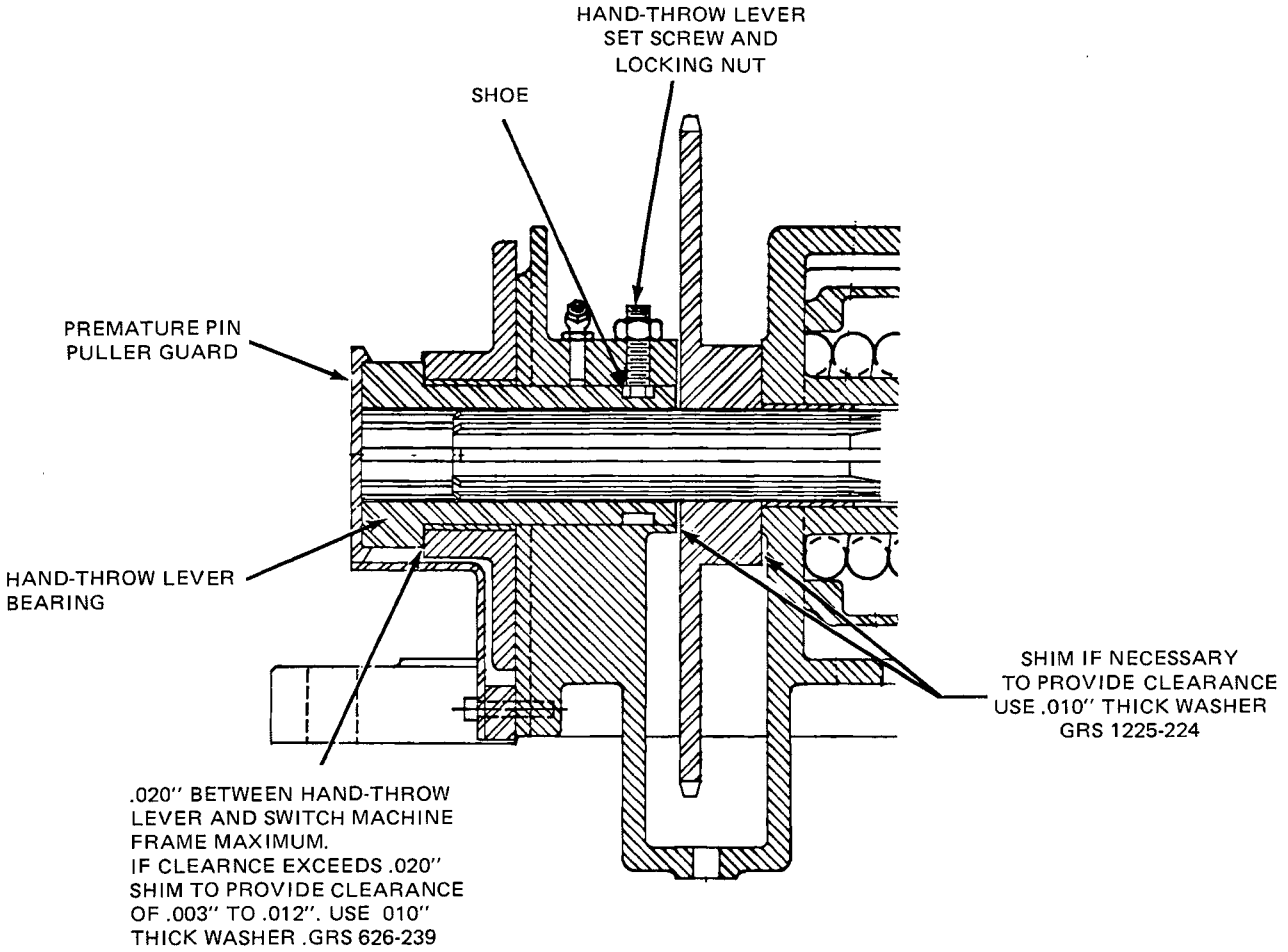


Figure 18. Correct position of hand-throw lever and switch machine frame.

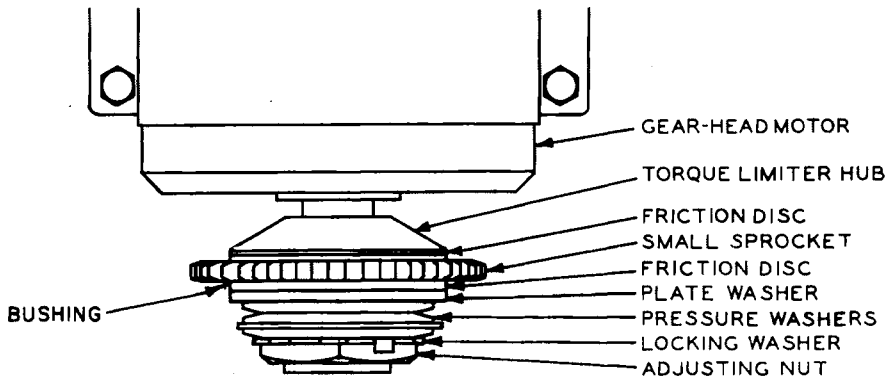


Figure 19. Torque limiter.

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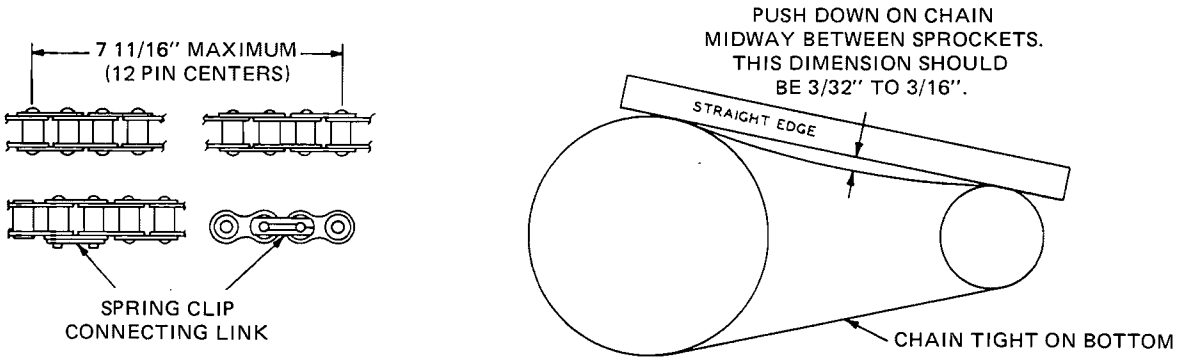

Figure 20. Chain slack adjustment.

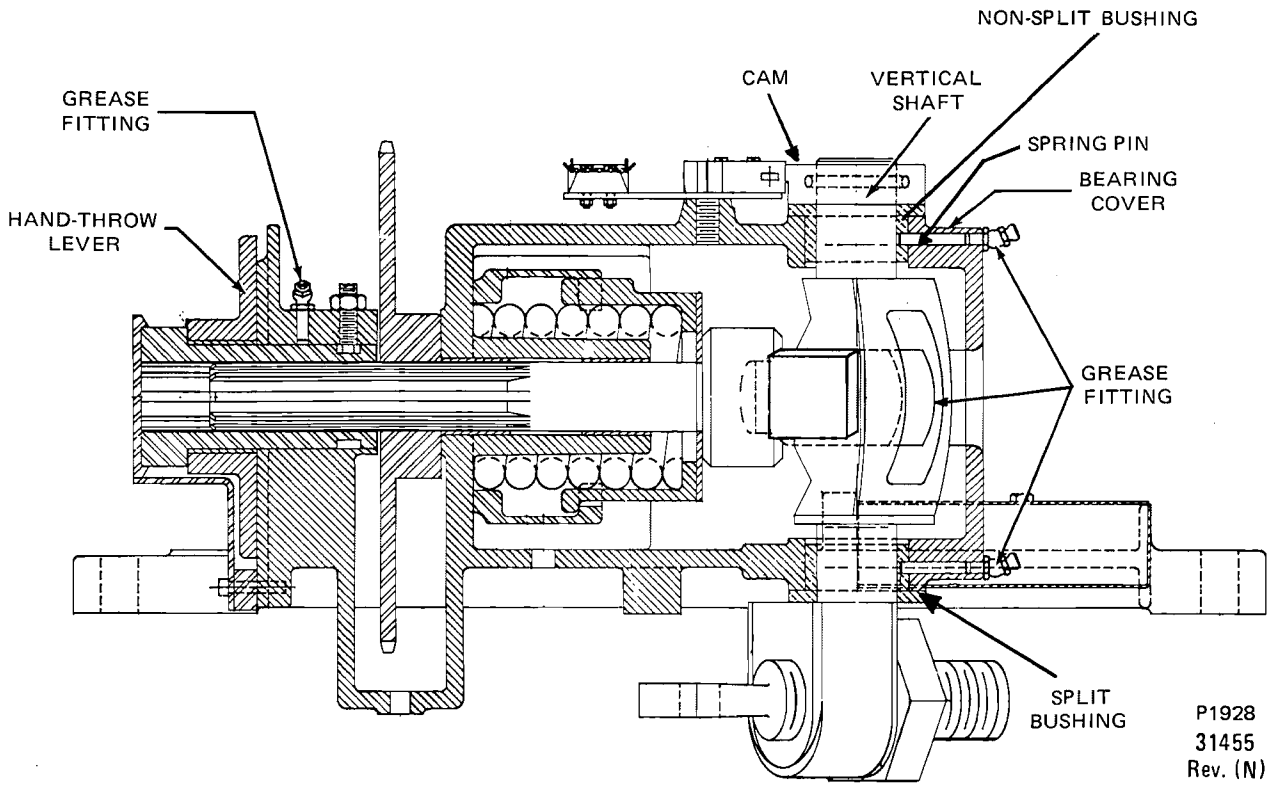

Figure 21. Location of pressure fittings.

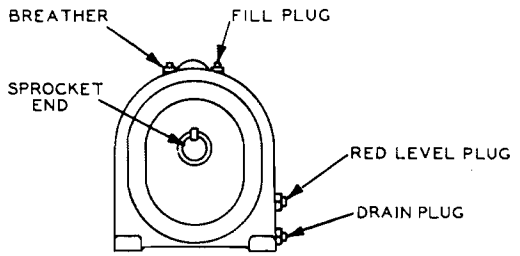

Figure 22. Location of plugs on motor gear head.

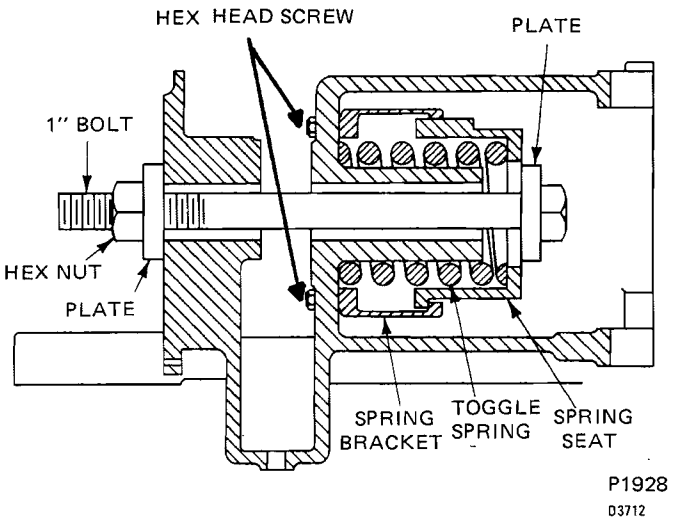

Figure 23. Details of toggle spring assembly.

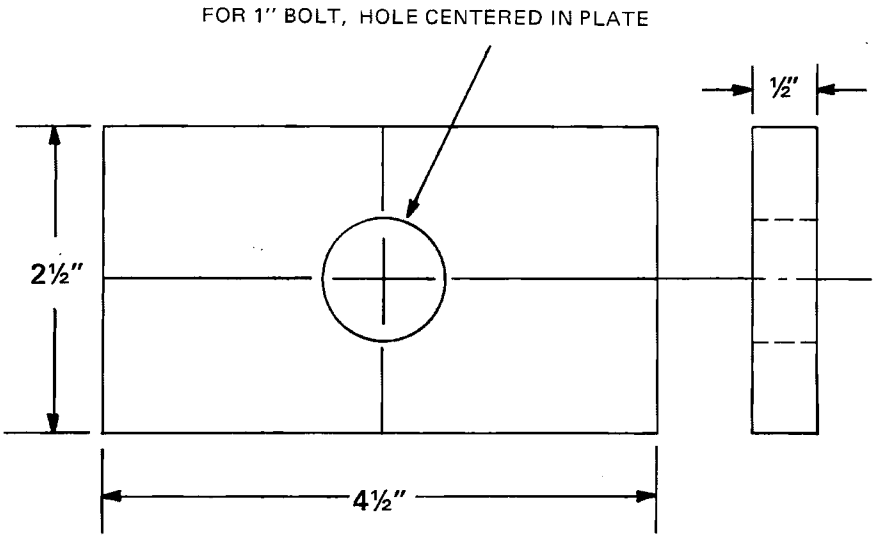

Figure 24. Steel plate details.

Notes:

Notes:

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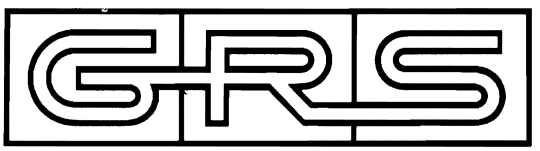

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